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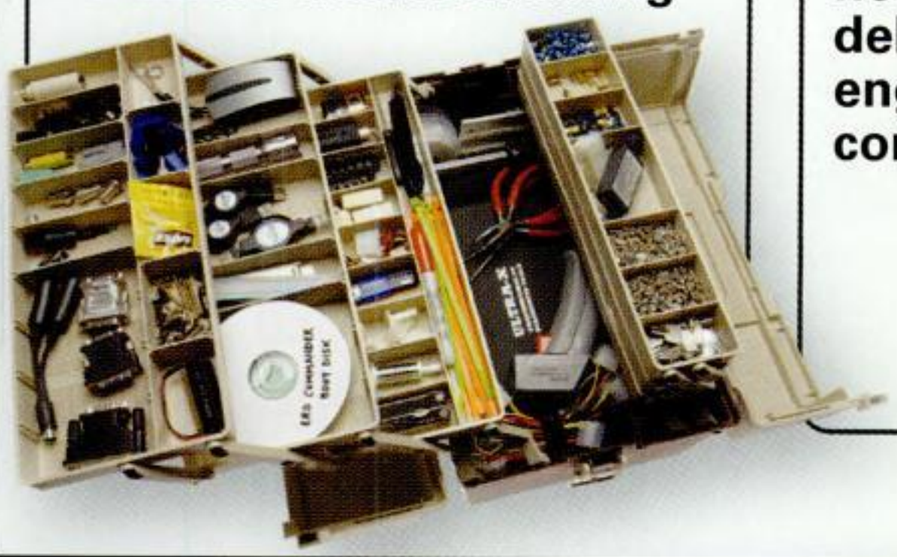

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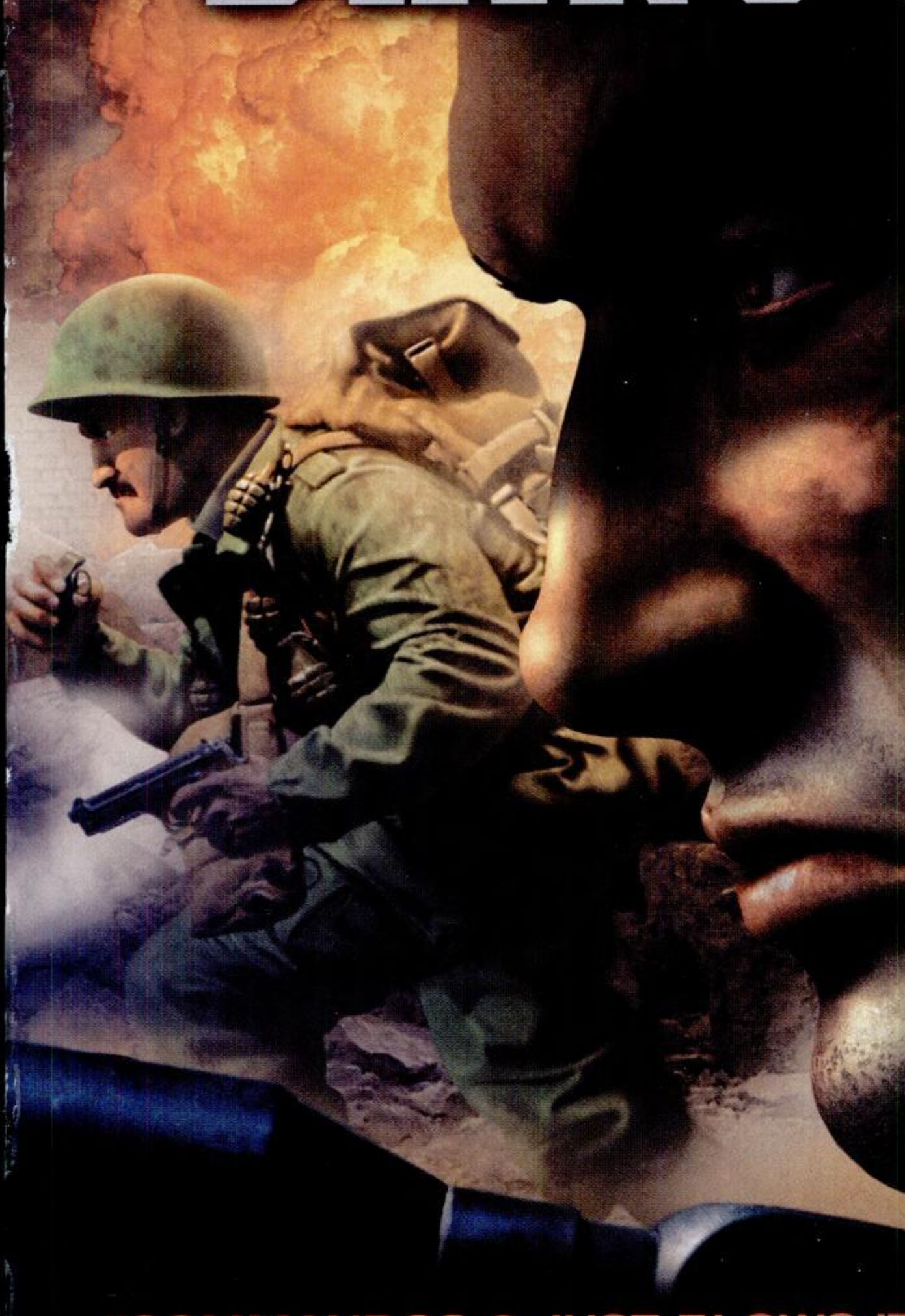

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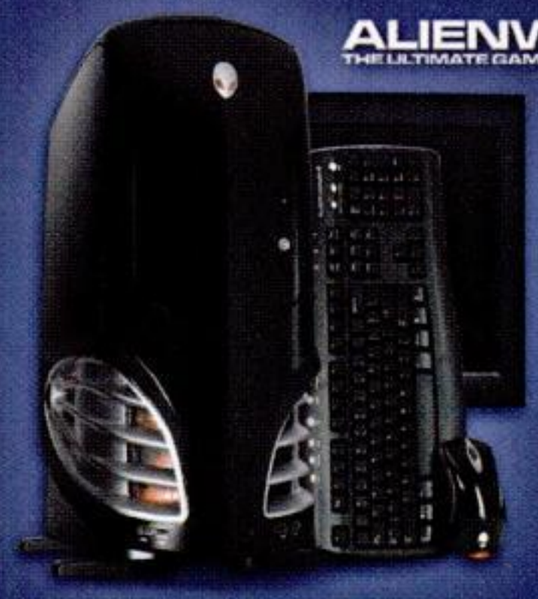

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Release Notes

The Three Most Often-Asked Questions I Find in My E-mail Box

▶ "Now that the Dream Machine 2003 project has been benchmarked, can I have the machine, seeing as how you're done with it?"

Every Dream Machine is built with numerous loaner parts from hardware manufacturers, and we can't in good faith simply give the parts away. But even more importantly, Dream Machine 2003 is no longer "with us" in the form of a single, living entity. In the days following its final performance testing, it was summarily dismantled, and its sundry components have since been distributed across the Lab.

That said, I will do my best to pry the Dream Machine's Wave Master case from Gordon's clutches, and if I'm successful, I'll use it as a contest prize in some future magazine-sponsored game of skill or chance.

▶ "I'm building a new system, and I just can't choose between Product X and Product Y. You guys are smart; what do you think I should buy?"

Thanks, Timmy, you're very generous. But while we would love to give you advice on matters specific to hardware and hardware accessories, we're a bit overwhelmed with a little side business we've been running. It's called *Maximum PC* magazine. Nothing serious, more of a hobby, really. But the cool thing is that if you read *Maximum PC* on a monthly basis, you should find answers to all your hardware questions. *We do our best to publish all information and opinions that we think will benefit our readers.* If we have an informed judgment on a PC product, it will be expressed in the magazine.

(Sorry for the sarcasm, Timmy. Looks like I picked the wrong day to quit drinking 3D shooters; details on page 69.)

▶ "It looks like you guys have a lot of fun. How can a regular Joe like me get a job at *Maximum PC*?"

Yes, Joe, we *do* have a lot of fun. We get first looks at all the coolest PC hardware and software. We get to build systems, benchmark them, and tear them down again. And we get free gold masters of all the newest PC games.

Just make no mistake: We love technology, but we're not engineers. First and foremost, were magazine editors—wordsmiths, investigative reporters, and logical thinkers. So if you want to come aboard the *Good Ship Maximum PC,* you must be able to turn a phrase, report a story, and develop sound and defensible product reviews. We keep pace with PC technology by interviewing experts, and digging deep through white papers, but we're still journalists through and through.

And with that, I invite all readers to enjoy the next 100-odd pages. We do this job because we love it, and we are committed to giving you the highest-value PC magazine possible.

—JON PHILLIPS

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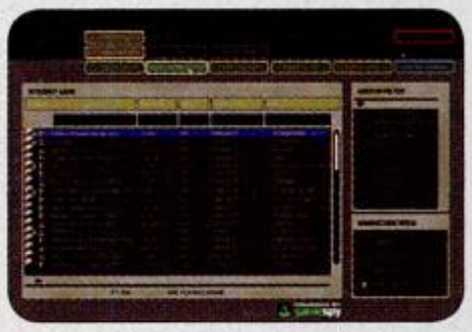

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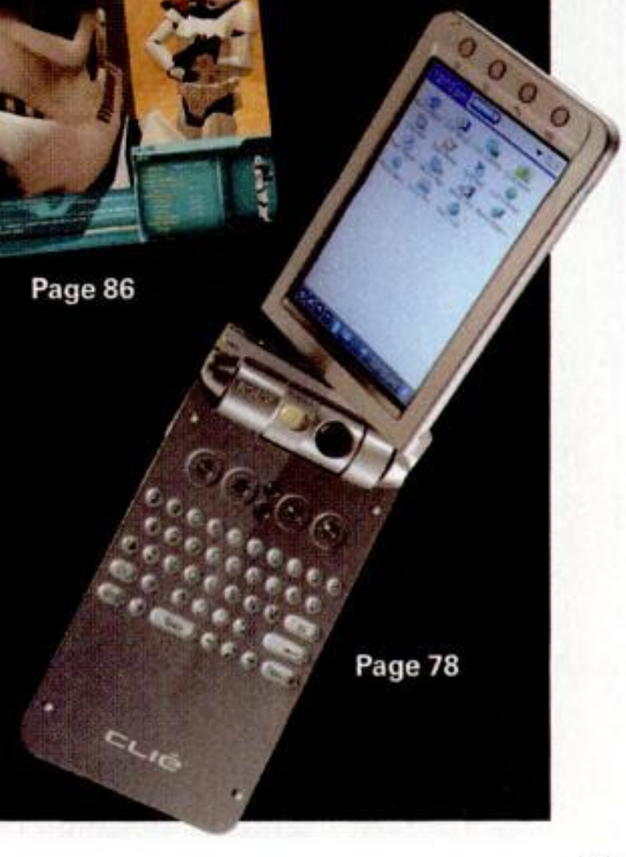

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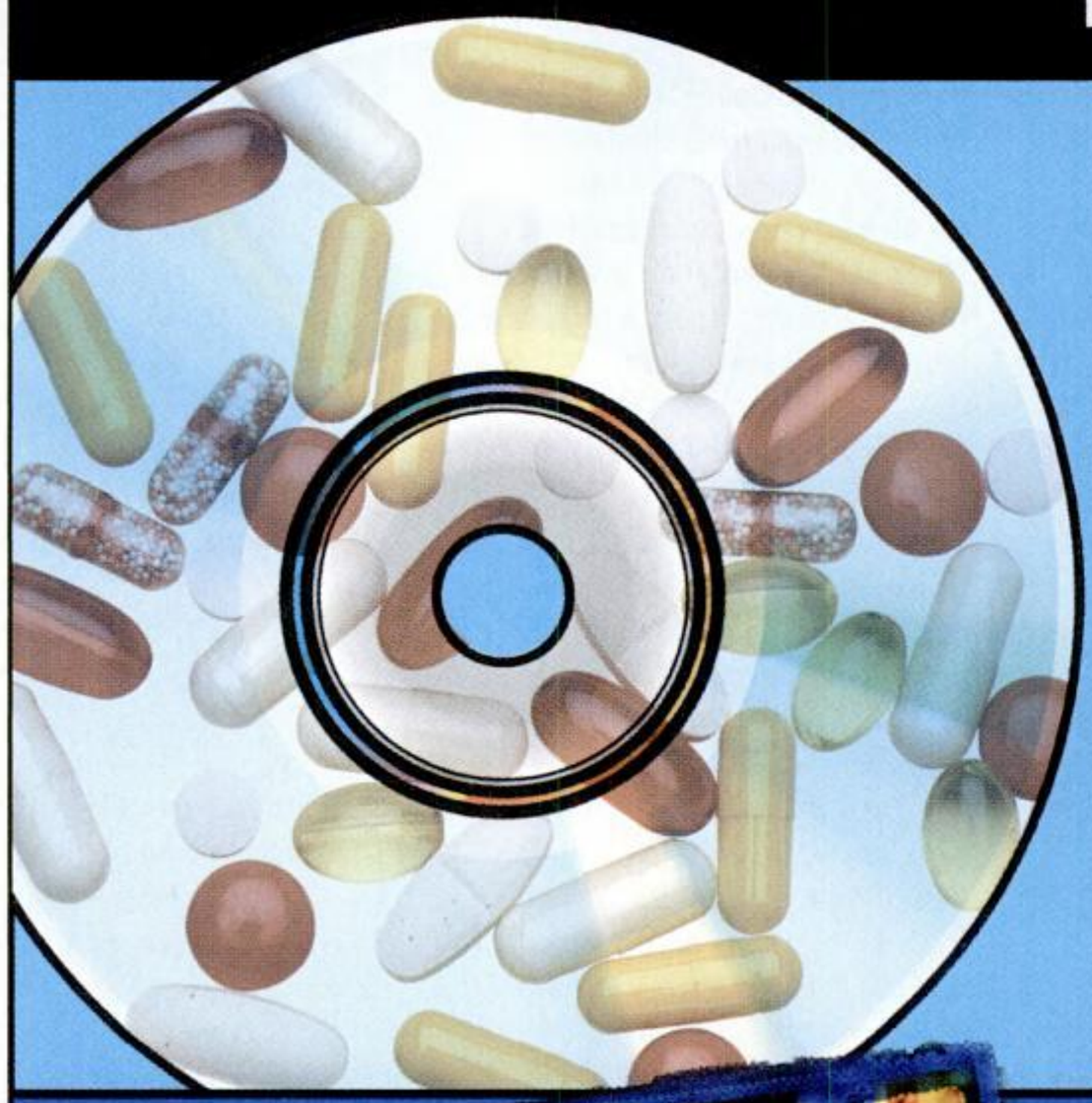

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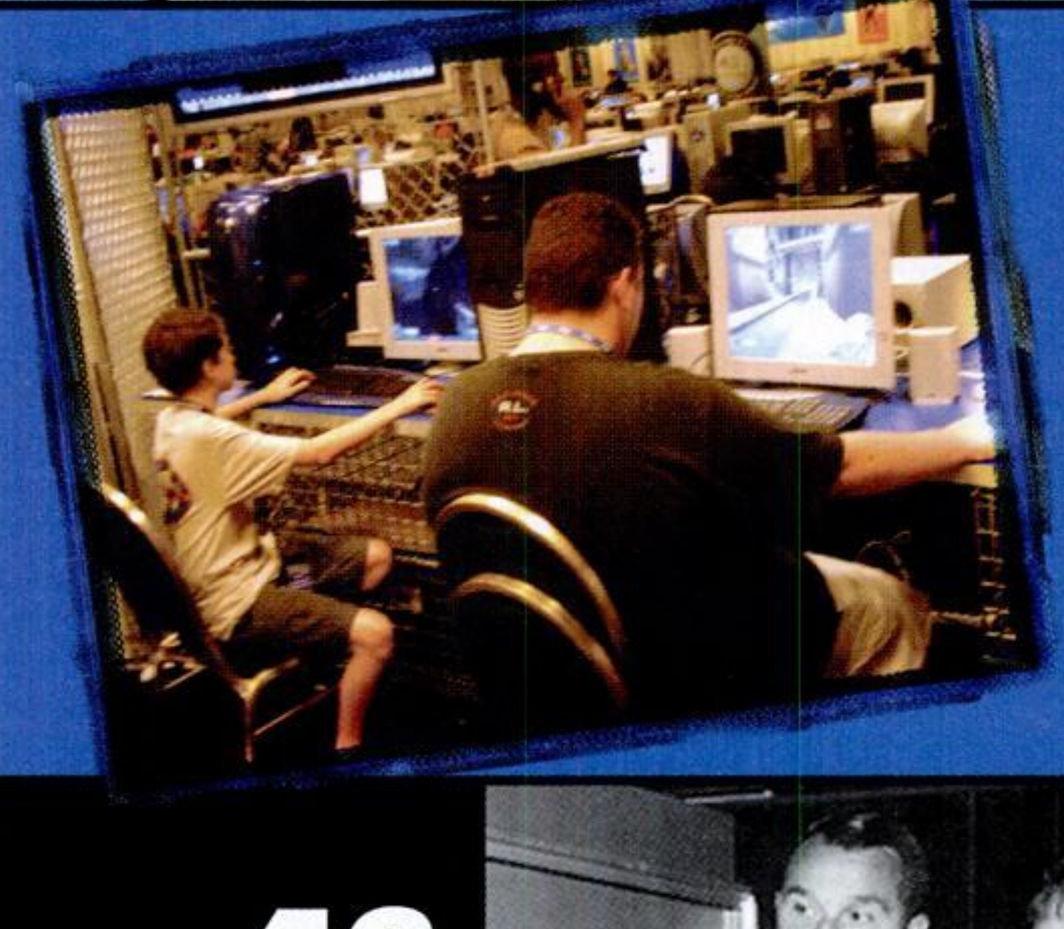

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Tech Editor Will Smith leaves the comfort and safety of his cubicle to judge the CPL's biannual case-mod contest.

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From voice coils to GMR heads, everything you need to know about your PC's beast of burden.

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In/Out

You write, we respond

500MHZ SHY OF GREATNESS

I must say that your overclocking results for the so-called "dream machine" [September 2003] were fairly lame. I understand that you needed stability and a stable overclock, but you are under the bar by many a good megahertz. Pentium 4 overclockers routinely run up to 4GHz on a daily basis, usually with phase-change cooling; 3.53GHz hardly merits "dream" status. And LN2 (liquid nitrogen) has provided flash overclocks of 5GHz, not 4GHz as you suggest.

—RICHARDS

EDITOR-IN-CHIEF JON PHILLIPS REPLIES: We obviously made a mistake in not explaining our configuration decisions in greater detail. Here's the deal: Like an elite supercar, any *Maximum PC* Dream Machine is a study in compromises.

When designing a supercar, a manufacturer must decide between a lower-displacement V8 and a higher-displacement V12—but that V12, while more powerful, might also demand a larger, heavier chassis. Fine, so why not give that smaller V8 an aggressive engine management program for truly outrageous horsepower? Sure, they could do that—but then the engineers would be sacrificing around-town drivability, and drivers would stall the car every now and then.

We specifically avoided phase-change cooling because it's big and bulky, and potentially problematic in the long-run. Speed is certainly a part of any Dream Machine equation, but this year we wanted to give a nod to convenience, aesthetics, and everyday reliability. Our Cooler Master Wave Master case looks terrific and is surprisingly portable for a mid-tower—and its tight, efficient formfactor will not accept a phase-change system. As for LN2, that would be a good technology for the PC equivalent of "jet fuel-injected funny car," but not for Dream Machine 2003.

Nonetheless, your point is well-taken. Maybe sometime between now and September 2004, we can run a "Maximum PC Challenge" in which we attempt to reach the highest overclocks possible. That's not our definition of a Dream Machine, but it's a very interesting proposition, nonetheless.

ANYTHING YOU CAN DO, I CAN DO BETTER

This year's Dream Machine is not a dream. I could build a better rig. You don't have any pre-release parts that push your machine over the edge. You didn't get an Athlon 64, but why not try a dual Opteron on a mobo with 8x AGP? Tyan has such a product. It may not have been much better than a 3.2GHz P4, but it would have been worth commenting on.

—STUART BOREEN

EDITOR-IN-CHIEF JON PHILLIPS REPLIES: Last month's Dream Machine 2003 cover story makes clear mention of the fact that we tried to get pre-release components from Intel, AMD, ATI, and nVidia, but none of the companies would play ball. As for using an AMD Opteron CPU, that certainly wouldn't have given DM2003 a performance boost (see page 70 in this issue for details), and running two Opterons in SMP wouldn't have made much difference either, especially considering that our benchmarks are desktop apps that don't support multi-threading.

KEEPING COOKIES IN THE OVEN

I find it very strange that AMD and nVidia were willing to shell out hundreds of Athlon 64s and prototype nForce motherboards for QuakeCon2003, but neither was willing to send you one of either for DM2003. Regardless, I think you managed to put out one of the better Dream Machine issues, even without silicon still warm from the factory.

—JERRY HATHAWAY

BUT DOES HE DO WINDOWS?

In your September review of the CyberPower Infinity 5900 Pro system, you knock CyberPower for a poor wiring job. I agree that the wiring job is sub-par, but yours is too. Just because you can spend only $1,000 on the Lean Machine 2003 doesn't mean the wiring has to look like a "rat's nest," does it? You obviously spent the time to clean up the wiring in the Dream Machine 2003. How about you let me have LM2003, and I'll clean it up myself.

—DAN ZAWIERUCHA

EDITOR-IN-CHIEF JON PHILLIPS RESPONDS: Would you believe that we couldn't fit zip ties in our $1,000 budget. Would you believe we were going for a poor-boy look to fit the "Lean Machine" theme? Would you believe that we just plain goofed?

EDITOR-IN-CHIEF JON PHILLIPS RESPONDS: What a difference three or four weeks makes. I'm sure that if we ran Dream Machine 2003 in the November issue instead of the September issue, AMD would have wanted to tease its Athlon 64 launch in our magazine. But AMD, like all chip companies, likes to control its product rollouts very carefully, and in 2003, we're finding it increasingly difficult to get early silicon from anyone under any circumstances. The competitive stakes are simply higher than ever before.

That said, I'm not sure if we would have wanted "Athlon 64." Check back next month for clarification on this mysterious comment!

BEYOND THE REACH

It's noble that you say you want to configure DM2003 to be the type of rig that anyone can build, but what about the handpicked P4, videocard, memory, and cooling rig? How much luck do you think I'd have calling up Intel and asking them for their best, most overclockable, multiplier-unlocked CPU?

The Dream Machine is just that—a dream. It should rightfully have top-of-the-line, hard-to-get parts, and it should instill jealousy in the hearts of geeks everywhere. But DM2003 leaves me with nothing but a headache.

—ADAM B.

EDITOR-IN-CHIEF JON PHILLIPS REPLIES: Well, the fact is, you can purchase almost all the parts we used, you just can't get handpicked samples. And if it makes you feel any better, it's very likely that some regular-old consumers can achieve DM2003-caliber overclocks with the parts they have at home (many chips have a surprising amount of headroom—it all comes down to the luck of the draw). As for Voodoo's cooling rig, there's a very good chance it will be available to the public as a stand-alone kit in the months ahead.

NOT SCUZZY ENOUGH

When you build the Dream Machine, you build it with the idea that price is not an issue. Well, then, why on Earth did you use IDE hard drives instead of SCSI? Wouldn't a RAID array of four 15,000rpm Seagate SCSI hard drives annihilate even a RAID array of Western Digital Raptors? In a machine like

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Dream Machine 2003, where the sky is the limit, why go IDE?

—CODY KELLY

TECHNICAL EDITOR WILL SMITH REPLIES: Dream Machine 2003 is intended to be the ultimate home user's machine—a rig that would excel in common, everyday applications, with an emphasis on 3D games. And for 3D games, SCSI RAID doesn't make sense. Most desktop users can't tap the full potential of a SATA RAID array, much less a SCSI RAID array. The only real benefit that SCSI RAID would offer is the lower seek times granted by 15,000rpm drives. But even that is a minor upgrade, now that there are 10,000rpm Serial ATA drives available.

Any *Maximum PC* Dream Machine should be a configuration marvel, but it should also serve as a blueprint for readers to build their own machines, and we didn't want to tacitly endorse SCSI as a must-have technology for home consumers (and home consumers make up 99 percent of our reader base).

YEAH—THAT'S EXACTLY WHAT WE WERE THINKING, TOO!

Just wanted to let you all know that I thought the DM2003 was the best, most realistic, kick-ass Dream Machine yet (and I have been a reader since *boot* issue 1). It was the perfect blend of real-world parts and big spending. It combined style, stability, and performance. Anyone can go out and build this, if they want to throw down the coin. That's what the Dream Machine should be.

—ERIC GRIFFIN

STOP, THIEF!

Shame on you. Yes, we all know you are MP3 aficionados and love your stolen music, but to print an article that actually tells users the best way to steal ["MP3 Trading Under Attack," September 2003] is just plain wrong. Would it be alright for people to go to the local car dealer and steal a car? How about food from a grocery store? Songs are products, just like cars and food. Stealing is stealing, and MP3 downloaders are stealing. Period. Just because the stealing is easy or anonymous does not make it right.

—EDWARD REASOR

DO YOU SMELL SOMETHING BURNING?

I found the September issue article about sharing a broadband connection to be well done, but I wish it had a warning that putting CAT-5 cable inside your heating vent is a very bad idea. Standard CAT-5 cable releases toxic fumes when ignited. The fumes travel quickly in heating vents and can cause severe respiratory distress. It's the kind of shortcut I would've taken if I hadn't been working towards my CCNA.

—SCOTT MARSHALL

TYPO OR CHARACTER ASSAULT?

In your September 2003 Head2Head you wrote, "Although the DRU-510A's packaging says the drive will write to DVD+RW at 4x, that's a typo. The real speed is 2.4x."

Sony's web site, however, says the drive can write to DVD+RW at 4x. Is Sony lying? Did Logan forget to use 4x DVD+RW media in the DRU-510A? What's the real story?

—STEVE BREY

FEATURE EDITOR LOGAN DECKER ILLUMINATES: Sometimes the early firmware that comes with the drives we receive doesn't get along with early versions of the optical media. Such was the case with the DRU-510A. We tested the drive with Verbatim's 4x media, and the DRU-510A refused to see anything beyond 2.4x. (Sony didn't have any of its own 4x media at the time.)

But you're right, the DRU-510A does support 4x DVD burning. We regret assuming it was a typo. Nonetheless, even if the 4x media worked correctly (which it does now with our current stock), the DRU-510A's overall performance would still have been left in the dust by the Pioneer A06, which won the Head2Head. ■

> *"SONGS ARE PRODUCTS, JUST LIKE CARS AND FOOD. STEALING IS STEALING, AND MP3 DOWNLOADERS ARE STEALING. PERIOD."*

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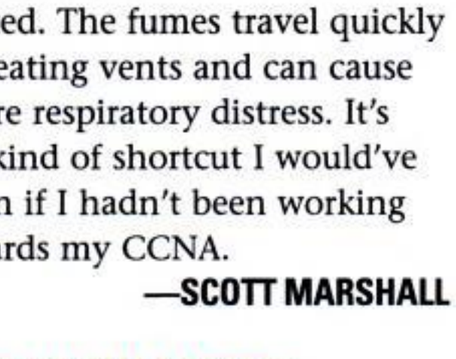

CUT, COPY, PASTE

➤ In our September issue, we published the incorrect price for the 20-inch Sharp LL-T2020 LCD display. The correct price is $1,500, thus the total price for Dream Machine 2003 is $8,185.

➤ In a September In/Out reply, we mistakenly used the word dynameter, when we meant to use the word dynamometer. A dynameter is an instrument used to measure the power of a telescope. A dynamometer is used to measure the mechanical power of car engines. Thanks go to T.J. Tran for pointing this out.

➤ Due to a printing error, we left out the last sentence of Tom McDonald's Game Theory column. Here's how it should have read: "...You've got yourself a business sim designed by people who don't seem to understand basic capitalism. My guess is Norwegians."

➤ In last month's issue we promised "The Maximum PC Challenge," but you'll discover that no such article appears in this issue. Expect to see it in a future issue.

COMING NEXT MONTH

IN THE HOLLER-AT-A-PLAYA, YO NOVEMBER ISSUE OF MAXIMUM PC

Make Your Own PC ENTERTAINMENT CENTER!

Imagine: a single PC that can replace your DVD player, your TiVo, your game console, and your home stereo—and it will let you surf the net from the comfort of your favorite recliner! We'll show you what to buy, and how to put it all together.

Athlon 64: the FULL Report

AMD's desktop CPUs have been trailing their Intel counterparts for what seems like an eternity, but now the underdog says it has a new chip that will kick much P4 ass. So what makes Athlon 64 tick? And what do you need to know in order to upgrade? And how does the CPU *really* perform? We answer all your 64-bit questions, and more!

WINDOWS SERVICES: the Ones You Need, and the Ones You Don't

If you want to squeeze every last drop of performance out of your PC, maybe it's time for a little Windows washing. Hundreds of tiny applications called "services" run in the background of every Windows installation, and every single one of them likes to nibble at your CPU cycles. We'll tell you how to find them, which ones shouldn't be messed with, and which ones ought to be 86'd.

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Quick Start

The beginning of the magazine, where articles are small

Straight Outta Tokyo

We give you a sneak peek at the coolest mobile gear you may never have the pleasure of using

The coolest mobile gear doesn't come from Silicon Valley, it comes from the tech wizards of the Far East. Intrigued? Then check out this frontline report from *Mobile PC* magazine. When it launches in January 2004, *Maximum PC's* new sister publication will run monthly scoops on the latest gear coming out of R&D in Japan, Singapore, and Korea. As you can see from this early report, the cell phone is becoming the definitive personal computing and entertainment platform in Asia.

Wethinks It Can Be Used for a Drinking Game

How small is too small? A pair of South Korean venture firms called Station Z and Eratech claim to have developed the world's teensiest, tiniest MP3 player, measuring just 42mm in diameter and 10mm thick, and weighing just 15 grams. This is little larger than a U.S. quarter. The device, called the EMP-Z, recharges through its USB port, which doubles as an earphone jack. Just don't mistake the player for loose change.

Couching Tiger, Hidden Connection

A Singapore startup called Neuston (**www.neuston.com**) has released a DVD player that supports MP4 video clips—DivX, Xvid, etc. The company's philosophy: If you can burn it to disc or buy it off the shelf, you can watch it on our Maestro DVD Player DVX-1201. Supported media formats include audio CD, DVD, VCD, MP3, JPEG, you name it. But what's really cool is the company's latest, still-in-the-labs trick: a player that receives videos via Wi-Fi. This means you can beam video directly from your PC to your living room. Think of it as Wi-Fi to your hi-fi.

Snap, Print, Go

In Singapore's Suntec Convention Center—a sort of paradise for nerds—a nifty kiosk has sprouted up for digital camera users on the go. The QuikPrint terminal accepts all common media storage cards, and prints out photos for 50 Singapore cents each (about 25 cents, U.S.). Unlike other such kiosks, it spits out your shots in just minutes, and the photo quality is equal to what you get at a photo development store. Bonus: no creepy Robin Williams character making a shrine out of your pix.

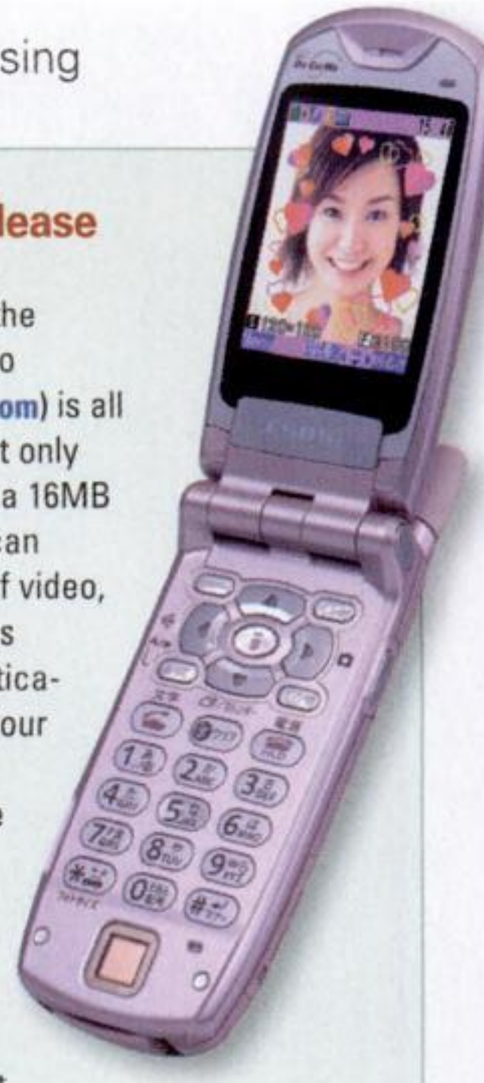
Bending over Backwards

The Sony-Ericsson joint venture has gotten off to a slow start, but Nokia better watch its behind if the S0505i is any indication. Not only does the phone's display swivel around, it can also slide down over the keyboard, effectively halving the size of the handset. Buttons just below the display let you surf, check e-mail, and even receive calls sans keyboard. As if that weren't enough to make your lame-o western celly look completely second-rate, the S0505i also sports a 1.3-megapixel camera with 16X digital zoom. Available only in Japan. Hah!

Anything Good on the Phone?

In December 2003, digital TV broadcast signals will flood the airwaves of Japan's major metro areas. A few years later, those signals will begin carrying TV shows made specifically for viewing on mobile devices. NEC, a big supplier of digital TV infrastructure systems, has developed a cell phone that can play these shows without running out of juice before their endings. The prototype will be unveiled at this October's ITU Telecom World Expo in Geneva. Question: How will they pick up Japanese TV signals in Switzerland?

Fingerprint, Please



One of the latest phones in Japan, the F505i from DoCoMo (**www.nttdocomo.com**) is all about security. Not only does it come with a 16MB miniSD card that can store 29 minutes of video, it also incorporates fingerprint authentication. You provide your fingerprint when you sign up for the service, and you can later register up to nine more prints. A pad at the bottom of the handset reads paw prints—if your digits don't check out, the phone remains locked.

Wrist-Twist Action

Dick Tracy-san would have loved the Wristomo (**www.wristomo.com**) from NTT DoCoMo because he always had too many gadgets in his bulging pockets. You wear the Wristomo on your wrist just like a watch. When a call comes in, you press two release buttons to pop open the metal straps and—hey, neato—you've got a traditional-looking cell phone. One day, pocket-space will be as plentiful and cheap as DRAM, especially with Americans' ever-expanding waistlines. But until that day, there's the Wristomo. Too bad it's sold only in Japan, and works only on DoCoMo's quirky PHS mobile network.

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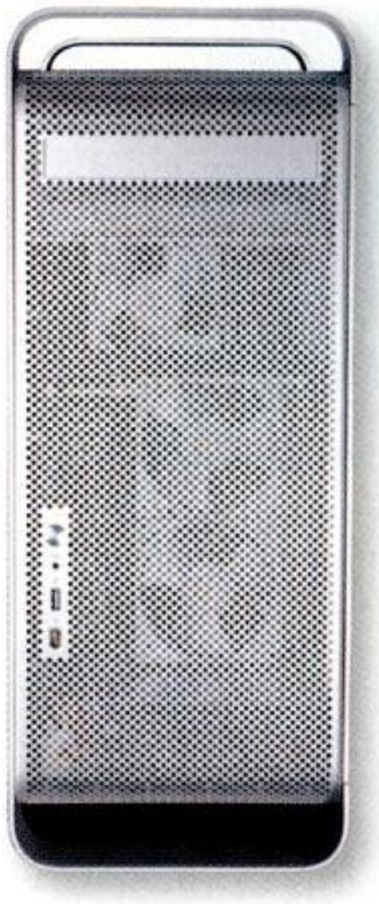
Apple G5 Update

Here's what we currently know about the new Mac—so please quit asking!



Apple's fall fashions: It's all sleek lines and cool aluminum coming out of Cupertino this year.

Apple's new flagship system, the G5, was announced in June with the usual bluster about PC-beating performance, ease-of-use, and how it will cure all of life's ills. Then, on August 19, the first G5s started shipping—but they were only the 1.6GHz and 1.8GHz machines, not the dual-proc 2GHz boxes that *Maximum PC* readers have been dying for us to benchmark.

How does Apple's finest machine perform, you ask? Well, we won't be able to tell you until the only truly interesting G5s begin shipping, sometime in late August (we expect to have a showdown story in the November issue). But we can tell you that the G5's sleek new case is another mind-blowing performance from the Apple design department, and the platform's specs do sound formidable.

The G5 is based on the new PowerPC G5 processor, developed jointly by Apple and IBM. The Big Thing about the 0.13-micron G5 is that it's the first shipping desktop CPU to use 64-bit data paths, as opposed to the 32-bit paths used in the Pentium 4, Athlon XP, and Apple G4 processors. This 64-bit architecture neatly sweeps away theoretical bottlenecks, such as the 4GB RAM ceiling. Apple and IBM also widened their data freeways in the form of a whopping 1GHz frontside bus with two dedicated, unidirectional 32-bit data paths to and from the processor.

Apple owners reading this from behind locked doors can relax, because the G5 won't require existing apps to run in any type of slow emulation mode. Software, however, will need to be recompiled to take advantage of the 64-bit architecture and all its inherent speed.

Bizarrely, Apple's optional DVD/CD combo burner still doesn't officially support the rewriteable DVD-RW spec, although *Maximum PC* has it on good authority that the drive is perfectly capable of it. The G5 also ships with FireWire 800, USB 2.0, and a big-whoop AGP 8x slot. The currently shipping 1.6GHz and 1.8GHz boxes come with GeForce FX 5200 Ultras, and the 2GHz dual-proc boxes will come with Radeon 9600 Pros.

Apple calls the G5 "the world's fastest personal computer." We'll see about that. Check back with us next month (we're still waiting for our test unit), for a showdown among the fastest G5 and its desktop PC counterparts.

Steve Jobs recently said, "The Mac not only caught up with the PC—it passed it."

FUN-SIZE NEWS

Internet Helps Thwart CO Poisoning

The matter is settled—PCs not only enhance our lives, they preserve them, too. Linda Bundy of West Virginia was text-chatting with pal Jackie McEvoy of Yorkshire, England, complaining that her family slept all the time—and then Linda fell asleep mid-chat.

Jackie's son Dave put two and two together, identified Linda's "silence" as carbon monoxide poisoning, and called paramedics in Linda's home town. A carbon monoxide leak was found, and the entire Bundy family was saved. Meanwhile, in Massachusetts, Richard Machado sniffed smoke during a late-night bout of *Dark Age of Camelot* and hustled six family members to safety from a fire in their building.

Microsoft: No SP2 until 2004

According to Microsoft's Windows Service Pack Road Map, the next update package for WinXP won't be released until 2004. Service Pack 2 is expected to bundle all the security "hotfixes," patches, and drivers that have been released since the original Service Pack 1, which was ponyed up in September 2002. Strangely, this news comes shortly after the Blaster worm threatened the Windows Update process and had Microsoft executives murmuring about making security updates automatic, if not mandatory.

Throwing Good Worms After Bad

Speaking of the Blaster worm, hot on its heels was a variant known as "Blaster.D," which actually patched PCs to defend them against its predecessor. Once a PC becomes "infected" with the Blaster.D worm, it scans the machine for the specific vulnerability exploited by the Blaster worm. If this vulnerability is found, Blaster.D forces the machine to download and install the patch from Microsoft's servers. The Blaster.D worm also carries instructions to delete itself in 2004. As of press time, no one had claimed responsibility for the benevolent Blaster blaster.

MPAA Strikes Back

In a pre-emptive strike against file traders who exchange copies of pirated movies on the Internet, Motion Picture Association of America Chairman Jack Valenti brought Hollywood talent together to create a series of promotional spots intended to discourage PC users from movie piracy. *Gigli* was released in late July. Another Ben Affleck and Jennifer Lopez collaboration is expected to be released several months later.

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DiskOnKey Hits the Big Gig

Don't you have one of these things yet?

Once you start carrying around a USB flash memory storage device like M-System's DiskOnKey, you can't live without one ever again. And now this simple floppy-replacement concept—flash memory inside a small keychain-size device with a USB connector that needs no drivers—just went from practical to downright luscious.

M-Systems is trotting out the 1GB USB 2.0 DiskOnKey for $550 (www.diskonkey.com). One gig of portable storage in a sturdy plastic case less than four inches long. Not only are we able to load an entire DivX movie on the key, but with the speed of USB 2.0, we can watch it from the device as well! Maybe movie theaters should give this method a shot.

The DiskOnKey is also available in 128MB, 256MB, and 512MB versions as well, in a number of questionable J. Crew-esque colors.

Better than Sea Monkeys. Better than dessert. It's 1GB of flash memory that goes where you go.

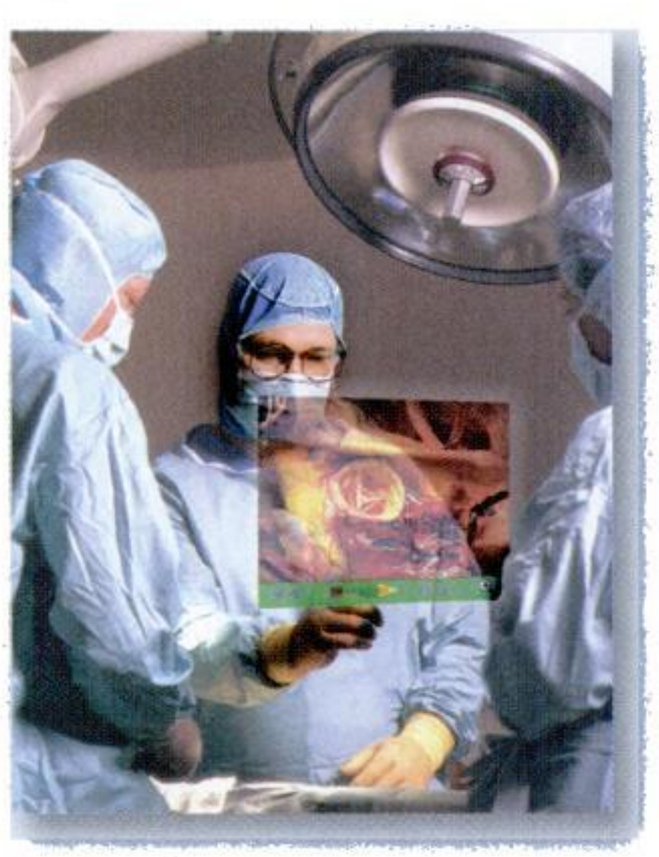
The No-Touch Screen!

Floating interfaces aren't just for the movies anymore

Verminophobics are terrified of germs. With a condition like this, commonplace surfaces like telephone keypads, ATM machine interfaces, and even the buttons of a good friend's iPod become menacing killing fields, crawling with invisible horrors. Well, thank heavens for HoloTouch, a touchscreen interface that doesn't have any surface whatsoever.

How it works isn't explained very well in US Patent 6,377,238, but here's the gist: A holographic image is projected in the air, but this isn't just any ordinary hologram, it's also an interface. An infrared sensor constantly monitors the projection, and detects the intrusion of a finger into any part of the image. Then, just like any other input device (such as a mouse or keyboard), it transmits the appropriate selection to software.

Although designed with medical and military applications in mind, the possibilities for HoloTouch are staggering. Imagine: No more nasty food-encrusted keyboards!



HoloTouch has demonstrated a number of different applications for the HoloTouch device, but this is the grossest one we could find: instant playback for surgeons.

FAST FORWARD BY TOM R. HALFHILL

When Smaller Is Better

Size matters, according to the spam clogging my mailbox. Bigger is better, and I can increase my size by 30 percent in 30 days if I act now. Too bad. What I really want is to get smaller.

The smaller the transistors in my PC's microprocessor, the faster they can switch on and off while doing their binary ballet—and the faster my computer runs. That's why AMD, Intel, and every other chip company is spending billions of dollars to shave a few atomic layers off the transistors in their future processors. They're also trying to maintain relatively high drive current (the electricity that flows through the transistor when it's on) while minimizing the amount of leakage current (the electricity that seeps out of the transistor when it's off). Shrinking a transistor tends to make both parameters worse.

Lately, AMD has been touting its fully depleted silicon-on-insulator (FDSOI) metal-gate transistors, while Intel has been showing off its nonplanar tri-gate transistors. Both types of transistors should appear in PC processors within a few years.

AMD is refining the silicon-on-insulator (SOI) technology pioneered by IBM. SOI reduces a transistor's capacitance so it can switch more rapidly between its on/off states. Ordinarily, the transistor's gate—in effect, the on/off switch—is made of crystalline polysilicon on an insulating gate-oxide layer. As I noted last month, these insulating layers are only about five atoms thick in the latest transistors. They can't get much thinner without leaking enough current to short out the circuit.

AMD's solution is to fully deplete the semiconductive polysilicon gate into a metal (nickel silicide), which has the effect of thickening the insulation only at the base of the gate. In combination with another technique called strained silicon, it allows AMD to make smaller, faster transistors that don't leak like a sieve.

Meanwhile, Intel is moving experimental tri-gate transistors from the lab to the fab. Tri-gates are tiny 3D structures etched into silicon, unlike regular planar transistors, which are basically flat. This would seem to make the transistors larger, which is bad, but they triple the area of the gate's junction without increasing the gate's length, which is good. Result: The chip can drive more current to switch the transistor faster, without blowing out the gate like a fuse.

Every year, a hyperventilated critic warns that the sky is falling on Moore's law and microprocessors will stop getting faster, smaller, and cheaper. Someday, yes, but not soon. Besides, Moore's law isn't really an accurate way to forecast the progress of chip technology—but that's a controversial subject for another day.

Tom Halfhill was formerly a senior editor for Byte *magazine and an analyst for* Microprocessor Report. *He is now a technical writer/analyst in Silicon Valley.*

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Revenge of the MP3 Players

A tsunami of new audio devices descends from R&D

It's raining MP3 players this season. New storage gizmos and smarter designs are beginning to blur the lines between ultra-light solid-state players and capacious hard drive-based players. Here's some of what you'll see on store shelves from Creative Labs and Rio just in time for that fat guy in the red and white suit to make someone's day. Maybe your own.

Flyweight division

Creative Labs Muvo NX

Creative Labs' second-generation combo USB drive/MP3 player ups the ante with an LCD screen, a built-in microphone for voice recording, and an additional battery module. Just USB 1.1, but hey.

$150 for 128MB, www.creativelabs.com

Rio Fuse

Rio's own 128MB combo is ever-so-slightly larger than the MuVo, in an integrated one-piece that comes with Sennheiser MX300 earbuds. USB 1.1 only.

$130, www.rioaudio.com

Welterweight division

Rio Nitrus

Three inches long. Half an inch deep. One and a half gigs of storage. Two ounces. It's one of the first devices to use the new Cornice Storage Element, a tiny hard drive designed, well, for foxy treats like this one.

$300, www.rioaudio.com

Heavyweight division

Creative Labs Nomad Jukebox Zen NX

That name! Good thing they don't charge by the letter. Creative's iPod challenger offers 30GB of space for $200 less than that *other* company. The NX model is slimmer and lighter than the original Zen, includes a removable Li-Ion battery, and offers snappy USB 2.0 transfers.

$300, www.creativelabs.com

Rio Karma

Rio's Karma boasts the smallest formfactor of any hard drive-based MP3 player we know of, at less than three inches square and not even an inch deep. The internal drive has 20GB of room, and Rio even managed to squeeze not just USB 2.0, but an Ethernet port as well.

$400, www.rioaudio.com

GAME THEORY BY THOMAS L. McDONALD

Fun with Words

This month's Game Theory is about text adventures.

No, wait! Don't go away! It's not another one of those maudlin walks down gamer memory lane: "You kids with your fancy 3D accelerator cards! Why, when I wuz your age, young'un, we didn't have no graphics! We had a text parser and, *by gum,* we were glad fer it!"

No one really wants to listen to old-timey gamers reminisce about the wonders of *Zork* and *Leather Goddesses of Phobos*. Frankly, until a couple months ago, I hadn't given text adventures much more than a passing thought in about a decade. It was a transient form, here and gone, its time passed. A letter (written on paper!) from a reader of *Games Magazine* (a traditional puzzle and gaming magazine where I'm editor-at-large) called my attention to the new renaissance in what was now being called interactive fiction. I'd heard of interactive fiction, knew people were still creating it, but simply filed the information under "U" for "Useless Knowledge," along with MUDs and Unix.

That, apparently, was a mistake, because these are not your father's text adventures. "Interactive fiction" may sound like a high-tone and even pretentious name for something most of us remember as "Go west / pick up towel / stick towel in ear," but it's actually a fairly appropriate label. The work coming from the best of today's IF writers—such as Andrew Plotkin, Graham Nelson, Emily Short, and Adam Cadre—puts prose and storytelling front and center, with some games eschewing puzzles entirely.

Those games that do use conventional object-based and logic puzzles do so in a more satisfying way than most of the Infocom titles I remember. Let's face it: The text adventures of yore were full of pretzel logic and dead ends. With the availability of powerful IF programming languages like Inform and TADS, game design has become more sophisticated, and this is reflected in the terrific *1893: A World's Fair Mystery*, which accurately recreates the entire 1893 World's Fair in text and period photos, or the huge *City of Secrets*, with its 80 locations and some 300,000 lines of text.

One thing that particularly drew me to interactive fiction was its perfect fit with PDAs. Most of the game languages work on Pocket PC, which makes them great for portable gaming. A quick visit to Baf's guide to interactive fiction (wurb.com/if) provides the best starting point for downloading game files and readers, all but a few of which are completely free.

Sometimes we need a little distance from something to reevaluate it properly. I never would've dreamed I'd find myself playing text adventures again, but the medium has grown and expanded, particularly in the past few years, and it deserves to be considered a contemporary gaming genre and not just a quaint bit of nostalgia.

Tom McDonald has been covering games for countless magazines and newspapers for 11 years. He lives in the New Jersey Pine Barrens.

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Head2Head

A showdown among natural PC competitors

THIS MONTH: CD and DVD Mastering Software

If you've been burning CDs and DVDs for as long as we have, you'll find Roxio's *Easy CD & DVD Creator 6* and Ahead's *Nero Ultra Edition* to be virtual toy chests. The two disc mastering apps come with so many features, you could find yourself exploring their software interfaces for days. But if you're new to disc burning, you might be paralyzed by the sheer comprehensiveness of each suite.

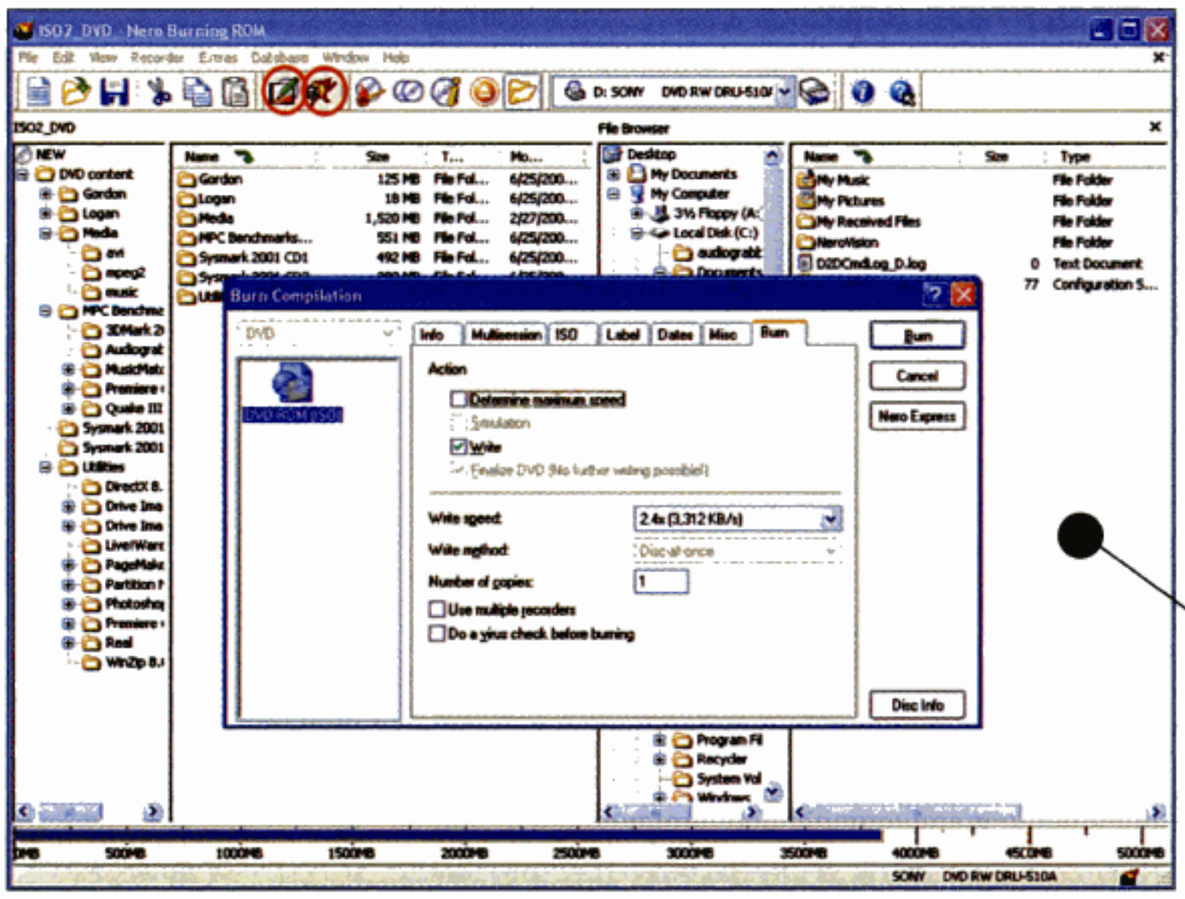
That's why we decided to compare the two packages in this month's Head2Head. Now that each suite is in its sixth iteration, it's time to pick one as our favorite so that newbies won't have to plumb the depths of two overwhelming apps. Please note that the two suites have reached parity as far as disc-burning performance. Gone are the days when one app would burn a disc measurably faster than its competitor (all recording settings being equal).

—LOGAN DECKER

NERO ULTRA EDITION

CD authoring: No excitement here, folks. Both apps burned identical amounts of data within two to three seconds of each other, and both apps offer simple, drag 'n' drop interfaces. Yawn. Let's move on. **Winner: Tie**

DVD authoring: Both applications are simple to use, and give you the option to use wizards to build your DVDs, or to slap together your discs without the help of electronic nannies. But when it came to creating slick menus for our DVDs, we found *Nero's* approach to be far superior. Interface buttons can be repositioned at will, and *Nero* provides the option to add your own looping audio and video backgrounds, along with the usual dumpster of goofy themes. **Winner: Nero**



***Nero* remains the feature creature, but Ahead's GUI is showing its age. Note the mysterious icons circled in red. One of these isn't even mirrored in the pulldown menus.**

Audio ripping/mixing: Audio ripping is executed in the main *Nero* program instead of the *Nero Mix* audio player, which didn't make much sense to us. But even worse, *Nero* permits just 30 rips to MP3Pro before demanding an upgrade, which costs $20. There's no option for standard MP3 encoding, but you can rip to WMA and AAC without penalty. This isn't devastating, because we like to do our own encoding using *LAME*. Still, it's ridiculous that an "ultra" version of *Nero* won't offer even basic MP3 encoding support. Neither app supports OGG files, by the way. For heaven's sake, this high-quality codec is free! **Winner: Easy CD & DVD Creator**

Interface: Although *Nero Ultra Edition* introduced SmartStart, a handy all-in-one interface that helps direct you to the right program, it feels like a tacked on solution to an integrated suite. And some features, like audio ripping, are nowhere to be found in the SmartStart menu. Maybe the Ahead folk were embarrassed about their MP3 encoding restrictions. **Winner: Easy CD & DVD Creator**

Backup: Although we prefer drive-imaging for data backups, *Nero BackItUp* is a handy utility that offers the standard full, incremental, and differential backup options. Unlike *Easy CD & DVD Creator, Nero* supports backing up to and from network drives, and even has a scheduling feature. **Winner: Nero**

Documentation: *Nero* offers just a slender Quickstart guide; the remaining documentation is on PDF files scattered in the directories of all the separate applications. As if this weren't bad enough, we found erroneous information, which didn't exactly raise our confidence. For example: "Existing audio files can be converted in order to improve their quality." No, they can't. Upsampling doesn't do a thing to improve quality—it just makes bigger files. **Winner: Easy CD & DVD Creator**

MAXIMUM PC VERDICT 8

+ DVD

Nero's still a great burning app that power users will appreciate, with lots of customization options for DVD menus and a strong backup utility that can be scheduled.

– CSS

The interface is taking a dive, and the boxed version desperately needs to be patched. And what's with the extra fee for MP3 encoding?

$100 boxed, $70 downloadable, www.nero.com

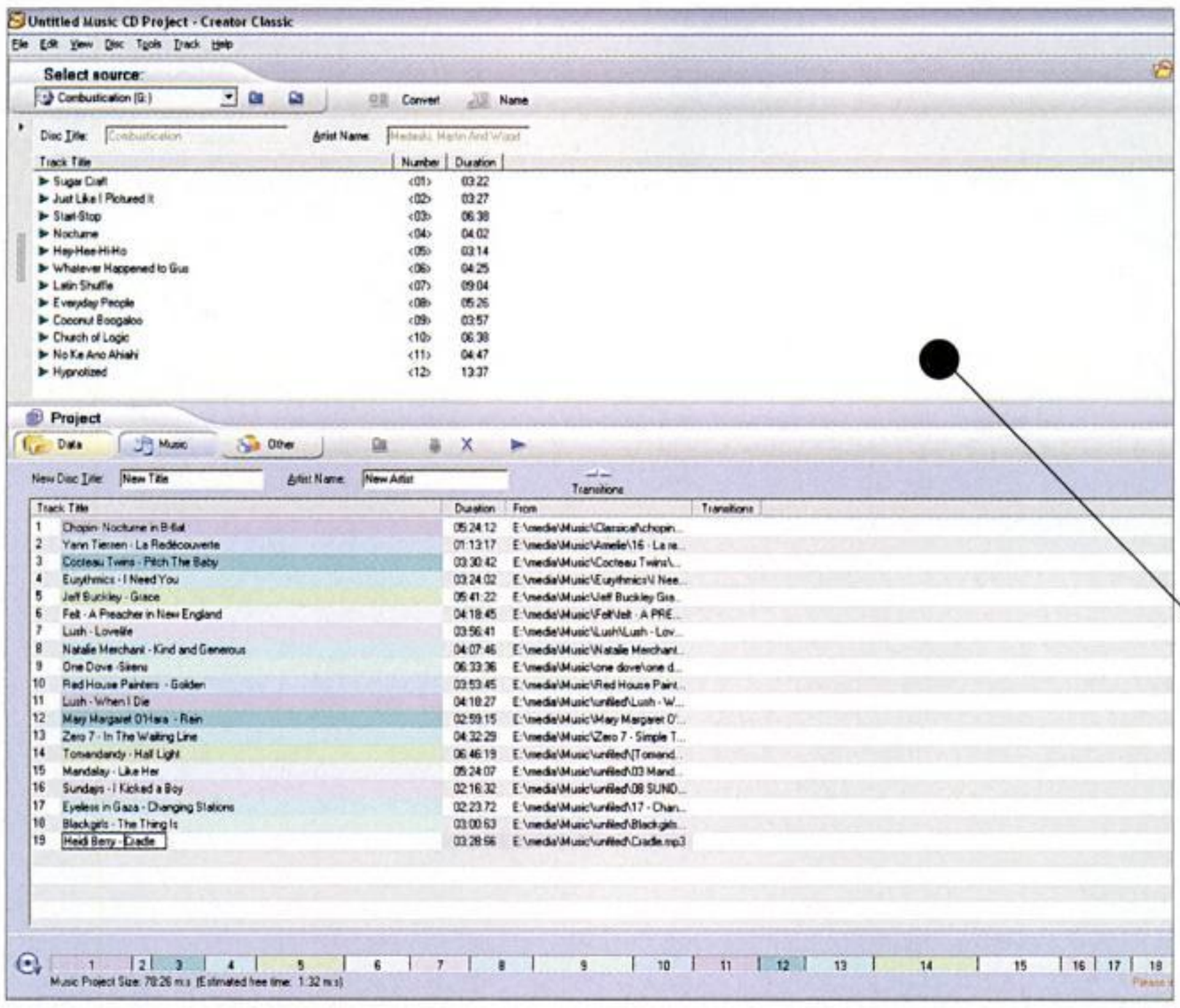
Copyrighted material

EASY CD & DVD CREATOR 6

CD authoring: There isn't much to distinguish one program from another. We ourselves would be hard-pressed to come up with cool new features for tasks as common as CD and CD-RW burning. **Winner: Tie**

DVD authoring: Creating and burning a DVD with *Easy CD & DVD Creator* is so simple, you might even do it accidentally. What dogged *Easy CD & DVD Creator* in this category, however, was the utter lack of options to tweak DVD menus—and the bundled menu templates are ghastly. **Winner: Nero**

Backup: *Easy CD & DVD Creator* doesn't freak out when you try to back up more files than will fit on one disk. Like *Nero*, it simply prompts you for another disk. Nice. But Roxio offers no option for differential or incremental backups, no scheduling function, and network drives aren't supported. *Easy CD & DVD Creator* provides backup essentials; *Nero* simply takes them further. **Winner: Nero**



This shot is typical of Roxio's *Easy CD & DVD Creator*. Note the bar at the bottom of the screen that shows the relative space that each audio track consumes, and how much space is left. Nothing revolutionary here, but it's just further proof that the folks at Roxio "get it."

Audio ripping/mixing: Roxio would have won this competition simply because it bundles a robust, no-excuses MP3 encoder. But it just so happens that Roxio's *AudioCentral* is much easier to use than Ahead's *Nero Mix* as well. Both apps support recording from analog sources via your soundcard, but we were disappointed that neither application supported OGG files. Hello? Once again, the codec is free, people! **Winner: Easy CD & DVD Creator**

Interface: Although we were frustrated that the *Easy CD & DVD Creator* window is impossible to minimize during the DVD encoding process, the app proved to be the easier to use of both suites. All the functions were where we expected them to be, and Roxio has been cured of the "dialogbox-itis" that infected earlier editions. **Winner: Easy CD & DVD Creator**

Documentation: With no physical documentation save for a Quickstart guide, and digital documentation spread out among multiple PDFs, *Nero* tanks in this category. Roxio, on the other hand, provides a voluminous 390-page book that's light on screenshots, but written in plain English. **Winner: Easy CD & DVD Creator**

MAXIMUM PC VERDICT 9

+ BURN-PROOF

Now comparable to *Nero* in terms of burning speed, it's also one-upped *Nero* with a graceful interface, a fine media player/ripper and overall stability.

− SECOND-DEGREE BURN

There are no DVD menu customization options beyond changing the text—and the templates are tacky.

$100 boxed, $80 downloadable, www.roxio.com

THE WINNER: ROXIO'S EASY CD CREATOR 6

We used to make fun of the funky, slow *Easy CD & DVD Creator,* but version 6 has earned our respect and recommendation. On the other hand, we were shocked to find that several features (like audio background tracks for DVDs and some transcoding tasks) in *Nero Ultra Edition* wouldn't work out of the box on any of three machines we tried it on. We had to download over 34MB of patches just to make them work.

Although these apps are both valuable feature-orgies, neither one is right for everybody. *Easy CD & DVD Creator* whups *Nero* in ease-of-use, documentation, and of course, MP3 encoding. But *Nero* offers a far more customizable DVD menu creator and a better backup utility.

We're holding off on the Kick Ass award for the package that combines ease-of-use, disc customization and generous features in one. Hey, Roxio and Ahead—we are *so* ready for round two.

Copyrighted material

Halo Invades

Now with online multiplayer

MATURE 17+
M
CONTENT RATED BY ESRB

Violence
Blood and Gore

BUNGiE www.bungie.net

gearbox software

POWERED BY gamespy

Recommended on Dell Dimension XPS

Microsoft game studios

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PC

HALO®

Join the battle. Live the epic adventure yourself. Unlock the secrets of Halo to save mankind from the ruthless Covenant swarms. Take the fight online in customizable head-to-head multiplayer competitions against up to 15 rival Master Chiefs. Break open a redesigned arsenal complete with the wicked new fuel rod gun. Then go mobile in the redeveloped Rocket Warthog and Banshee. This is Halo evolved.

www.microsoft.com/Games/Halo

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WatchDog

Say hello to Sophie, WatchDog of the Month.

Maximum PC takes a bite out of bad gear

THIS MONTH: The WatchDog goes after...

> Newcom > IBM > KDS Computers > Pixie Technologies

Rebate, What Rebate?

Nearly five years after consumers sued Newcom and retailers of its products over unpaid rebates, the companies involved have finally settled. As the Dog wrote in the August 1999 column: "It isn't a question of who didn't receive a rebate check—it's a question of who did."

Accounts of the figure differ, but it's estimated that some 250,000 to 300,000 people should have been paid rebates but weren't. When Newcom shut down its operation in 1999, attorneys turned their attention to the stores that sold Newcom's modems, videocards, and other accessories, claiming that the stores knowingly misled consumers into believing the rebates were still valid when Newcom had a history of not honoring them. At the time, retailer Staples told the Dog the suit was misguided because the store knew Newcom had a poor rebate history and thus was paying customers' rebates out of its own pocket. "Staples is the good guy in this," an official said at the time.

> *"ATTORNEYS WERE SUCCESSFUL IN GETTING SEVERAL OF THE COMPANY'S FORMER OFFICERS TO PERSONALLY PONY UP FOR THE REBATES."*

The settlement proposal doesn't admit any fault on the part of Newcom, Best Buy, Circuit City, CompUSA, Staples, or other retailers that sold Newcom products with rebates. The proposal is unlikely to get too many smiles from consumers, either. Consumers who were owed a rebate of less than $30 will receive a $10 discount off purchases exceeding $200 from the affiliated retailers. People owed more than $30 from Newcom will receive $20 off a purchase exceeding $400 from the retailers. To qualify, consumers must submit claim cards before the October 26, 2003 deadline. Claim cards and additional information about the settlement can be found at www.rebatesettlement.com.

Attorneys who filed the original suit said they understand if consumers are less than pleased with the outcome, but they're still happy that something came of it.

"I think we did a great job settling this when the real bad guy went defunct," attorney Peter Macuga told the Dog. "We are as happy as we possibly could be, knowing the condition of the law these days and the ability we had to push the defendants to the wall with what we had."

Macuga said the firm had to weed through an intricate web of partnerships and ownerships involved with Newcom to get the settlements.

Although Newcom was broke by the time the settlement was reached, attorneys were successful in getting several of the company's former officers to personally pony up for the rebates. Three of the officers will shell out some $1.1 million in cash to help pay the costs.

What's more, the U.S. Attorney's Office in Los Angles has filed various charges against some former members of Newcom's management. The alleged offenses include money laundering, mail fraud, wire fraud, and conspiracy.

You may finally get something for the rebate on this Newcom videocard—*five years* after you bought it.

75GXP Update

Just how many IBM 75GXP hard drives failed? That question is still being examined in the long-running class-action suit against Big Blue that alleges the company knowingly let a bad hard drive stay on the market.

During a hearing to determine whether the lawsuit brought by consumers should proceed as a class action, attorneys for IBM said that possibly 5 to 10 percent of the 75GXPs had been returned. However, those attorneys argued that the fact that drives were returned doesn't necessarily mean the drives were bad, just that they were returned. Judge Ronald Sabrow had tentatively ruled that the class would likely be certified based on the failure rate of the drives. But the standard cited by Sabrow requires that all the products would likely fail. IBM argued that because 90 to 95 percent of the drives were not returned, it was an incorrect application of the law.

Attorneys for consumers, on the other hand, argued that the failure rates were real and the percentage far higher than what IBM wants anyone to know. Lawyers for consumers said that one company purchased 5,000 75GXP drives and then returned every single one when the drives failed at an unacceptable rate. Computer maker Dell stopped shipping the drives and "never purchased" another when it saw failure rates that were eight times higher than the company's standard, attorneys for consumers argued. Canadian storage company Zentra experienced failure rates as high as 27 percent, attorneys said. The industry standard for hard drive failure rates is 0.5 percent.

During one technical support exchange "an employee at IBM asked incredulously, 'Do you mean to tell me we're shipping drives with a 17 percent failure rate?'," attorneys for consumers said in court.

Citing an internal e-mail from an IBM exec, attorneys for consumers sought to show IBM's knowledge of the problem: "This is an older product, and it looks like it has some inherent problems which we will not

The 75GXP's reputation went from thaumaturgic to turd when consumers began reporting mass failures with the hard drives.

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be able to address. I think all we can do is take some tactical actions to stop or minimize the bleeding," wrote the exec.

IBM officials told the Dog they could not comment on behalf of the company because of the ongoing litigation. Judge Sabrow still must rule whether to certify the class certification in order for the suit to go forward, and he seems to be leaning toward the plaintiffs. In his tentative ruling, Sabrow wrote: "A second unsolved issue is the effect of the consumer expectations and the danger or injury that might be caused when a defect manifests itself. A 1 percent failure rate may be expected and acceptable for shoes or zippers but unexpected and unacceptable for parachutes and brakes."

KDS Computers stopped making notebooks almost two years ago.

Microsoft Game Voice Muted and Now Dead

In July, the Dog advised you to stay away from Microsoft's SideWinder Game Voice, finding the company's inability to commit to future support for the product troubling. Well, it turns out the Dog's concerns were warranted:

"Microsoft has decided to discontinue producing its SideWinder line of PC joysticks, gamepads, steering wheels, and force-feedback enabled devices. Due to long-term category decreases, proliferation of manufacturers, and highly competitive pricing, Microsoft has decided to exit the Gaming Input Device marketplace for PCs with their SideWinder line effective immediately. Microsoft will continue to sell current SideWinder gaming devices while stock is available and is working with retailers to offer a combination of competitive pricing and other opportunities to allow them to sell their inventory. Microsoft is also determining the optimal course for use of the brand-name for the future and has no plans to manufacture new SideWinder devices for any platform," the company told the Dog.

According to the company, "Microsoft will continue to include support for those devices in future versions of Windows, for as long as these products remain viable. In much the same way native support has been built into Windows XP through the use of DirectInput drivers in DirectX, Microsoft will continue to enable game developers to support and customize the user's experience as they see fit."

Microsoft said the company will offer the standard limited warranty for any devices that are purchased or have just been purchased by consumers, and will work with vendors to provide out-of-warranty repairs for the "immediate" future. Microsoft will continue to make mice and keyboards.

Take the Dog's advice: Although the MS joysticks and devices were much beloved, it makes more sense to purchase a Logitech, Saitek, or Thrustmaster gaming device these days. Woof.

Microsoft has taken a USB-powered fire axe to its entire line of popular gaming peripherals.

They're Always after Me Lucky Charms

DEAR DOG: I bought a 17-inch Pixie monitor model 750. About nine months later, the horizontal sync went. Pixie's web site is gone and so is its tech support. The three-year warranty is now just a piece of paper. What happened to the company? And how do I get this fixed?

— JOHN TRAN

THE DOG RESPONDS: Luckily, the Dog had an agent in the neighborhood of Pixie Technologies' last known location. When the agent arrived, however, he was greeted by a company that had nothing to do with Pixie, which apparently cleared out some months before. The short story is that Pixie Technologies is likely gone, and it's not cost effective for you to pay someone else to fix the monitor (turn it into a terrarium or fish tank instead). It's also recommended that consumers not buy any Pixie monitor without being assured of warranty support. Woof.

KDS KFC?

DEAR DOG: I'm writing to the Watchdog about KDS Computers (**www.kdscomputers.com**). Is the company out of business?

I purchased two new Valiant 671DP laptops for my company and have had nothing but trouble with them. Last week one of them unexpectedly died. I think the motherboard failed and needs to be replaced. The other laptop needs service too, but is still in working order.

No one locally will service KDS computers; I've been told I will only be able to get service by the manufacturer. The KDS web site is gone, the phone number is disconnected. I checked around and it looks like it's out of business? I have one dead computer and one that needs servicing, and can't get either fixed. If KDS Computers is out of business, you should let other readers know it, in case they run into my problem.

— JUSTIN OLANIN

THE DOG RESPONDS: KDS Computers, which once sold notebook computers, is indeed fried chicken. KDS USA, which sells monitors and other computer accessories, is still in business. Although the relationship is hard to decipher, it looks like KDS USA is handling warranty repairs for the defunct KDS Computers. KDScomputers.com was likely just down the day you tried to access it, but your fear was reasonable. The Better Business Bureau gave KDS Computers a negative report and said consumers complained of delivery and refund problems. Also according to the BBB: "Some [KDS Computers] customers complained that laptop computers purchased from the company were received defective or in damaged condition. Many customers complained replacements were not received after returning defective laptops. Other complainants reported difficulty contacting the company, or that the company fails to send rebate checks as agreed."

At press time, the web site was functioning again. KDS officials said the company still offers service for any notebooks still under warranty, but out-of-warranty service is not accepted. If you're looking for a third-party vendor, the Dog understands that PortableComputer.com stocks most of the parts for KDS Computers notebooks, and offers some service. ■

"WHEN THE AGENT ARRIVED, HOWEVER, HE WAS GREETED BY A COMPANY THAT HAD NOTHING TO DO WITH PIXIE, WHICH APPARENTLY CLEARED OUT SOME MONTHS BEFORE."

Got a bone to pick with a vendor? Been spiked by a fly-by-night operation? Sic The Dog on them by writing **watchdog@maximumpc.com**. The Dog promises to get to as many letters as possible, but only has four paws to work with.

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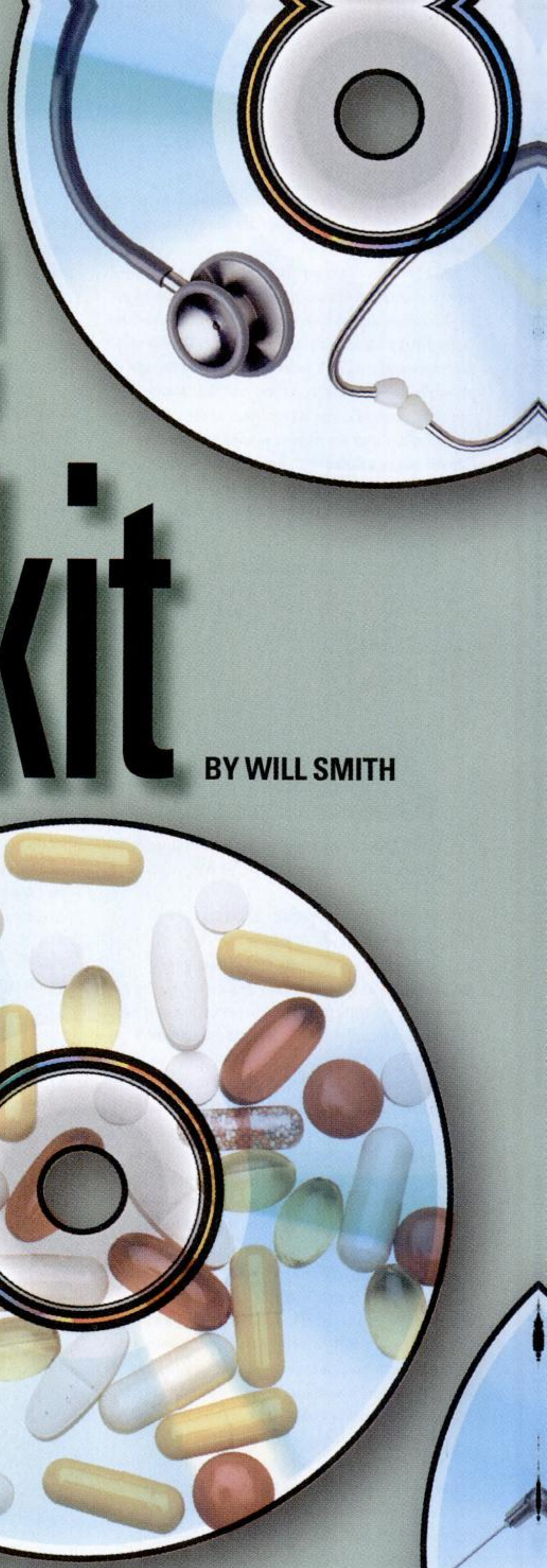
Ultimate PC Toolkit

BY WILL SMITH



We present the 12 best software fix-it utilities. Tested scrutinized, and 100% Maximum PC-approved

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Don't kid yourselves, power users, you *need* software utilities. Hands-on hardware upgrading is fun, and it can provide immense performance boosts, but only software utilities can help you keep your PC in tip-top shape. What's more, if you want to perform a few very specific activities—hard drive imaging or virus extermination, for example—you have to have just the right software tool for the job.

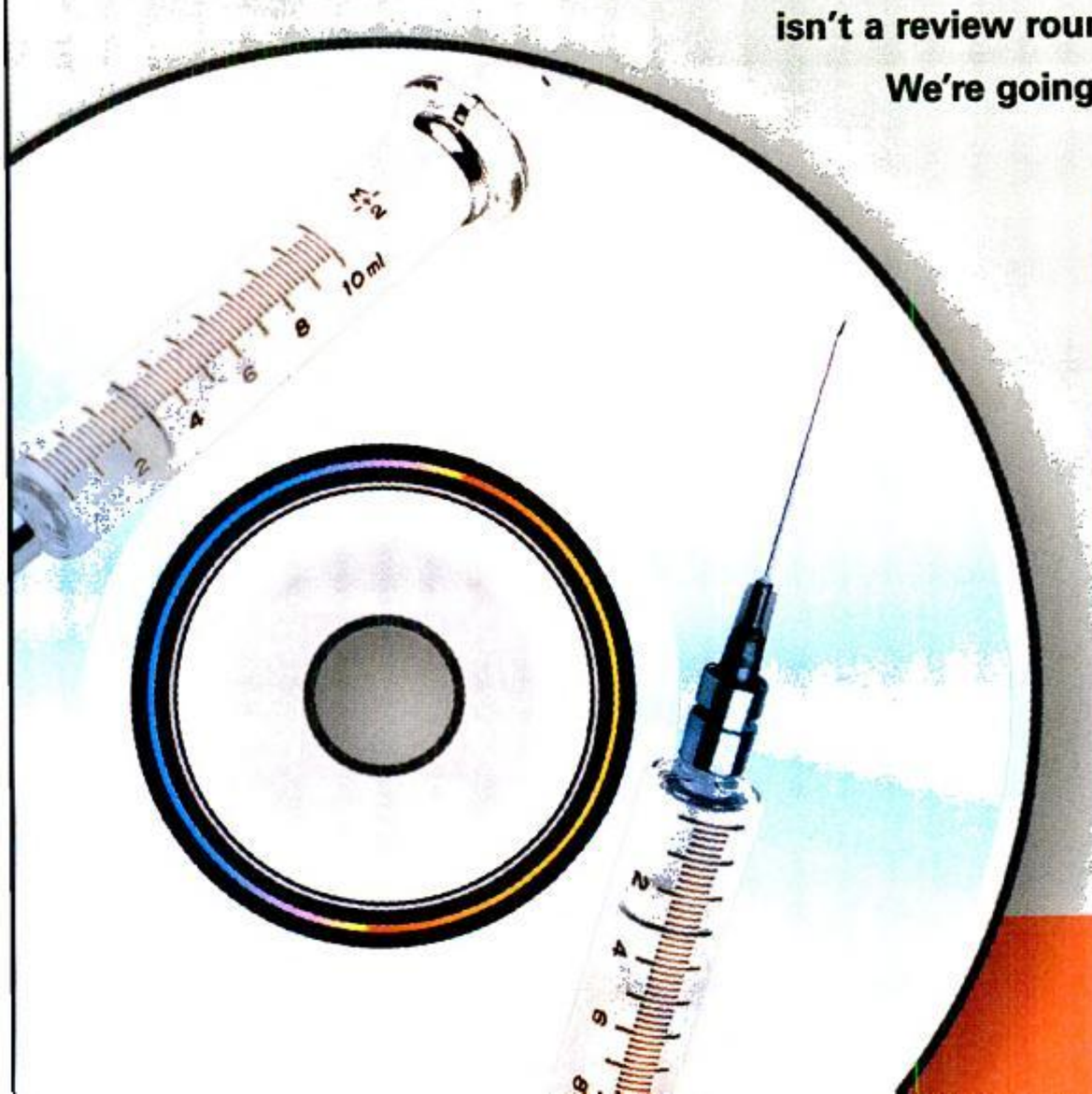
Unfortunately, figuring out which utilities are best is a daunting task. In each software category, you may be faced with dozens of options—big-name utilities, small-name utilities, free utilities, and utilities that cost way more than any software publisher should have the gall to charge. Add in all the wacky European utilities that have been ported to English for the U.S. market ("Yah, yah, it is Sweden's best-selling security software"), and you're bound to be confused.

Hence this month's article. No, this isn't a review roundup. We're going to cut to the chase, and simply tell you which utilities are our outright favorites.

We tested more than 30 utilities, from hard drive defragmenters to antivirus programs to spam-abatement packages to disk-imaging programs to network firewalls and more. We did all the homework so you wouldn't have to. In the next eight pages, we'll tell you which tools are must-haves, which are optional, and which are best avoided. And for people who are considering *Norton SystemWorks,* the all-in-one suite that ostensibly provides all the system therapy one could ever need, we've got that base covered, too. On page 34, we dissect the *Norton* package to let you know whether its everything-but-the-kitchen-sink approach can trump the individual, more specialized tools featured in this article.

Last but not least, we present you with the 2003 version of our ultimate PC trauma box. It houses everything from POST cards to zip ties, to 14 different types of screws, and even a spying device.

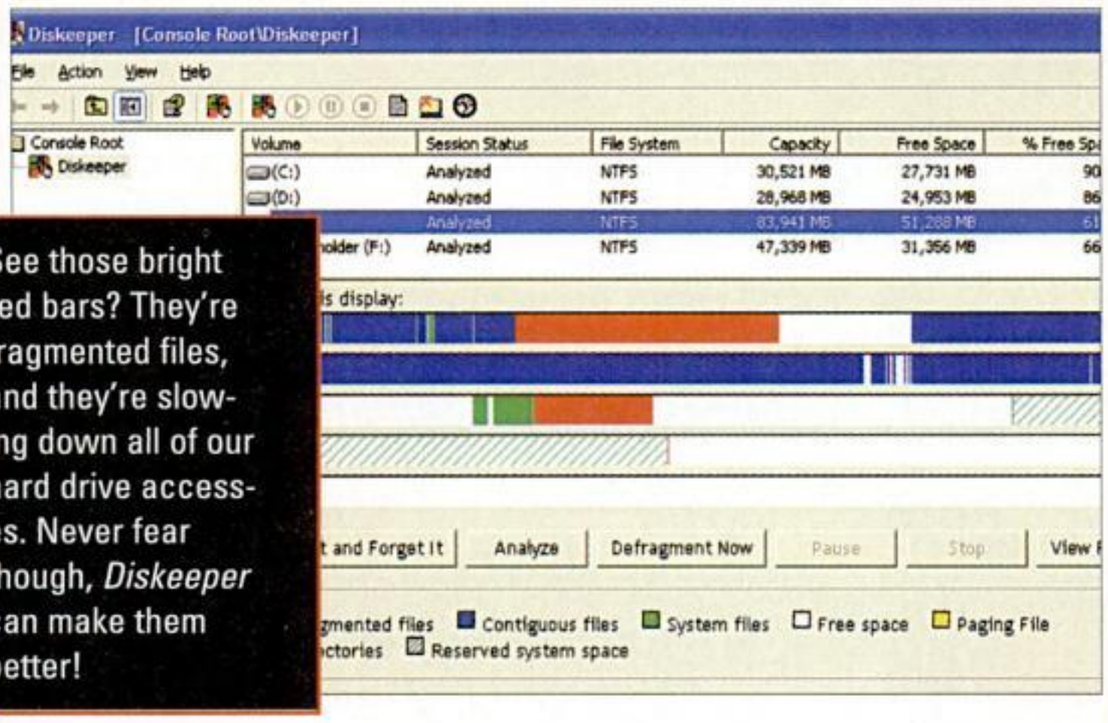
Now let's get out there and fix some PCs.



PICK YOUR TOOL

Defragging	28	Windows Recovery	31
Antivirus	28	Screen Capture	31
Firewall	29	Remote Access	32
Anti-Spam	29	File Recovery	32
Anti-Spyware	30	Uninstalling	32
Drive Imaging	30	All-in-One Suite	34
Drive Management	31	Hardware	36

HARD DRIVE DEFRAGGING



See those bright red bars? They're fragmented files, and they're slowing down all of our hard drive accesses. Never fear though, *Diskeeper* can make them better!

Diskeeper 7.0 Home Edition

When Windows saves a file on your hard drive, it doesn't always save it in on a single, contiguous section of a drive platter. Instead, it may break the file into smaller pieces that are saved on clusters all over the drive. Because their parts are scattered hither and yon, these fragmented files take longer to read than files that are saved in a contiguous cluster. For this reason, one of the easiest ways to improve your PC's performance is by properly "defragging" your hard drives.

All defragmentation utilities reorder file fragments until each file exists as a single contiguous chunk. *Diskeeper 7.0 Home Edition,* however, not only unifies fragmented files but also places the newly structured files in the most optimal positions on your drive platters—according to the way you habitually use your computer. For example, files that you open most frequently are placed near the center of a platter, where seek times are lowest. Windows XP already does intelligent positioning for a small number of system files, but *Diskeeper* does this for the whole shebang.

This isn't all that *Diskeeper* has to offer. The utility's unique "Boot-Time Defragging" feature lets you defrag system files that are usually untouchable, such as your paging file. And we especially love the "Set It and Forget It" feature, which offers an incredible degree of control over defrag scheduling. Then there's "Smart Scheduling," which monitors the fragmentation level of your drive, and runs defrag sessions either more frequently or less frequently as necessary. By using "Set It and Forget It" in tandem with "Smart Scheduling," your drives will stay tidy with nary a thought on your part.

Defragging makes apps load faster, decreases the time required to save files, and shortens the time it takes to load levels in games. Even though it was the second-fastest defragger we tested, *Diskeeper's* ease-of-use and extensive feature set make it our favorite.

www.diskeeper.com **$30**

ALSO CONSIDERED...

We evaluated three other defrag programs: *Norton Speed Disk* (included in *SystemWorks*), *Vopt XP 7.13,* and the defragger included with Windows XP. *Speed Disk* and the Windows Defrag program both produced acceptable results, but took a long time to chew through our test partition (44 and 33 minutes, respectively). *Vopt* was the fastest defragger—taking 23 minutes to *Diskeeper's* 26 minutes. *Vopt* also offers automatic defragmentation similar to *Diskeeper's*, but we think its interface is too confusing for anyone other than an Alpha PC Geek.

ANTIVIRUS PROTECTION

Norton AntiVirus 2003 Professional

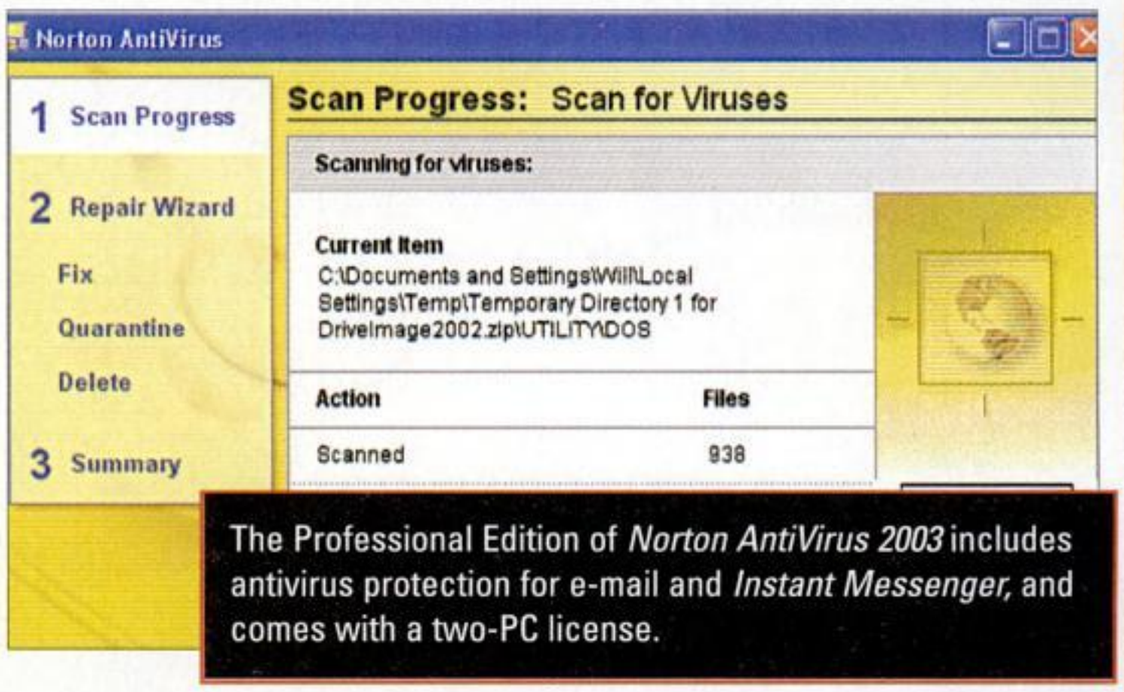
Norton's antivirus software does everything right—it's as simple as that. The utility sits unobtrusively in your system tray, checking all your incoming and outgoing e-mail, the stuff you download from the web, and the files you open on your PC. It's as quiet as a church mouse until a virus rears its ugly head. Then *Norton* pounces on the offender, cutting off its access to the vital parts of your PC, and keeping it from spreading.

While all of the above reads like a bare-minimum job description for an antivirus utility, you'd be surprised by how many competing utilities muck everything up. Indeed, *Norton* wins our recommendation not for what it does do, but for what it doesn't do. It doesn't have incompatibility problems with common firewalls and e-mail clients. It doesn't freeze your entire system every time it detects a macro virus in your incoming e-mail. It doesn't require you to register the product in order to download new virus definitions. And it doesn't require you to reboot every time you download a new definition file.

Performance, you ask? In our complete hard drive scan, *Norton* turned in the second-fastest scan time—a little less than eight minutes to scan a 30GB hard drive. Old Norty also achieved a 100 percent success rate in detecting the various viruses we seeded across the disk.

But what really sets *Norton AntiVirus* apart from the competition is ease-of-use. The utility is automatically configured to run daily checks for new definition updates, and if an update is available, *Norton* installs it automatically. During our week of Lab testing, we saw nearly twice as many new definition updates for *Norton* as we did for the competition. Even the best antivirus software in the world won't do you any good if it's not hip to the latest viruses, so *Norton* ultimately gets our props for keeping up with the most current events.

www.symantec.com **$70**
(also included in *SystemWorks 2003*)



The Professional Edition of *Norton AntiVirus 2003* includes antivirus protection for e-mail and *Instant Messenger,* and comes with a two-PC license.

ALSO CONSIDERED...

We also tested *McAfee VirusScan 7.0* and *Panda AntiVirus Platinum. Panda* was the fastest scanner we tested (40 seconds faster than *Norton*) and includes a basic firewall, but getting virus updates requires registration, and is more of a hassle than it should be. *McAfee VirusScan 7.0* could have been a contender, but we were concerned that it listed popular firewall *ZoneAlarm* as an incompatible program. Antivirus software should work with all common programs.

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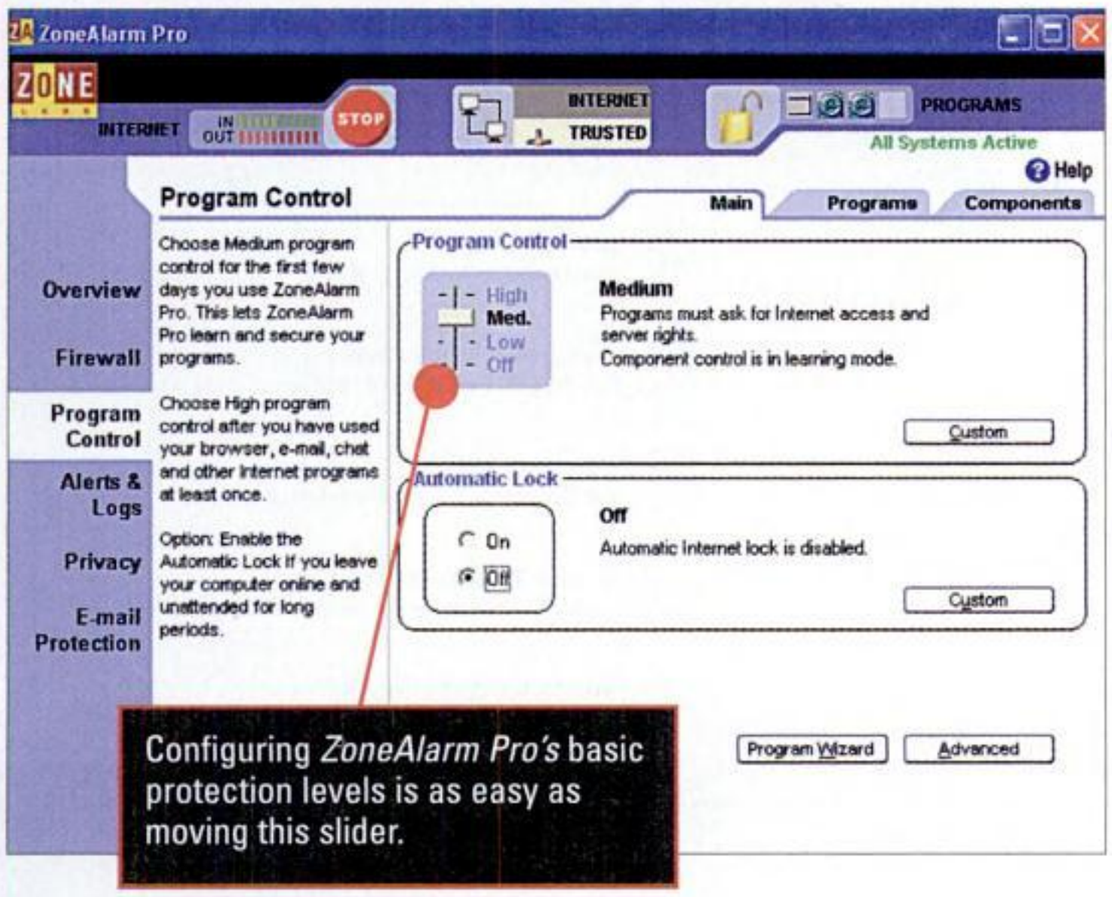
FIREWALL PROTECTION



Configuring *ZoneAlarm Pro's* basic protection levels is as easy as moving this slider.

ZoneAlarm Pro

Just like antivirus software, a good firewall is a must-have utility. A firewall sits between your computer and the wilds of the Internet, keeping evil-doers from gaining access to your PC's open communication ports. Some firewalls even block pop-up ads and filter spam. Sounds simple, and it should be, but most firewalls are designed *by* security geeks *for* security geeks, and are a pain to set up and an even bigger pain to live with.

Of all the firewall packages we tested, *ZoneAlarm* offers the easiest setup. Basic apps like *Internet Explorer* and *Outlook Express* are allowed through the firewall by default, but all other apps must go through a vetting process. In other words, after you install *ZoneAlarm*, you'll have to set Internet rights for all your apps that need to jump online to do business. This is a pain in the buttocks, because every time you load an Internet-savvy app, you'll be hit with a pop-up message asking for access. Luckily, the hubbub dies down after you set limits for all the apps you use regularly. The firewall just sits quietly in the background doing its job.

ZoneAlarm Pro even lets you give server apps permission to listen for outside connections, and advanced users can set up IP blocks as trusted zones. The trusted zones feature lets users on a local LAN easily bypass the firewall and connect to Windows fileshares and local servers, all while blocking outside users from the same resources.

The easiest way to tell if your PC is under attack is to examine your firewall's logs after a week of unfiltered access. If you do this, you'll probably see dozens of worms—similar to CodeRed—trying to infect your machine. *ZoneAlarm's* logs aren't as detailed as we like, but they provide enough information to alert a power user to a range of especially intrusive IP addresses (which can then be blocked wholesale).

www.zonelabs.com **$50**

ALSO CONSIDERED...

McAfee Firewall 4.0's interface is probably too difficult for a layperson to configure, but once you get past that, it's a powerful utility. *Norton Internet Security* includes a firewall, ad-blocking, and content filtering, but its interface is a confusing nightmare. The freebie version of *ZoneAlarm* offers the same firewall as the *Pro* version, but omits pop-up blocking, cookie management, and multiple security levels.

SPAM ABATEMENT

Spam Pal

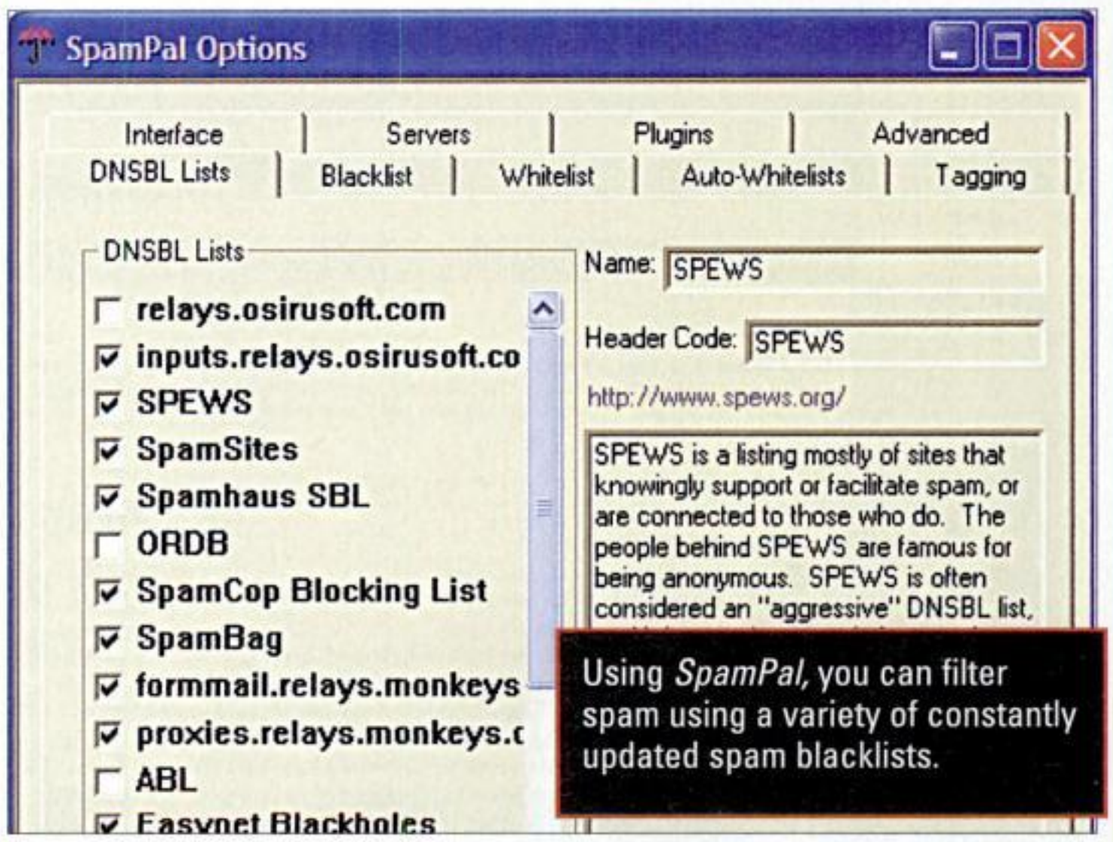
During the last year, spammers have stepped up their attacks, barraging unprotected e-mail users with an endless array of offers to enlarge assorted body parts and refinance homes. We even get spam that offers to eliminate spam!

There's a bevy of anti-spam products on store shelves now, but our favorite, *SpamPal*, is completely free. *SpamPal* is a free mail-classification utility that works with any POP3 client—this means it will work for any home user, save those who get their e-mail through a web interface like Hotmail. When your e-mail program downloads mail from your web server, *SpamPal* analyzes each message, and compares its sender and server hops to those in databases maintained by anti-spam crusaders. If *SpamPal* pegs a message as potential spam, it modifies the header, and adds a key phrase of your choosing. You can then set your mail program to filter spam based on that key phrase.

The upside to *SpamPal* is that it's highly configurable and works with nearly every mail client available. With blacklists (which label all mail from a specific IP address, domain, or e-mail user as spam) and whitelists (which label all mail from a specific IP address, domain, or user as valid e-mail), *SpamPal* gives you a strong fighting chance that you'll never see spam again. We experienced about a 95 percent success ratio.

SpamPal's price is certainly right—it's free—but it's not easy to configure and tweak. Nonetheless, this utility is in constant development, so the interface could improve. However, if you don't have a good idea of how e-mail moves about the Internet, you'll be better off with one of the other anti-spam solutions listed below.

www.spampal.org **FREE** **("donateware")**



Using *SpamPal,* you can filter spam using a variety of constantly updated spam blacklists.

ALSO CONSIDERED...

We also tested the MailGuardian service (**www.mailguardian.net**), which filters spam using *SpamPal*-like techniques. For $30 a year, MailGuardian will filter spam and viruses for you. We were also impressed with the *Inboxer* for *Outlook* anti-spam plugin (**www.inboxer.com**). It uses Bayesian filtering to automatically sort spam. Once trained, *Inboxer* produced the most consistent results (it's arguably better than *SpamPal*) but works only with *Outlook*, and not even *Outlook Express*. Finally, the McAfee *Spamkiller* product should be avoided at all costs. Its interface is unwieldy and its filters are inaccurate.

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ANTI-SPYWARE

Spybot Search & Destroy

Spyware is a broad term for any type of software that installs on your PC without your knowledge, and hides in the background, conducting online activity that you surely wouldn't appreciate.

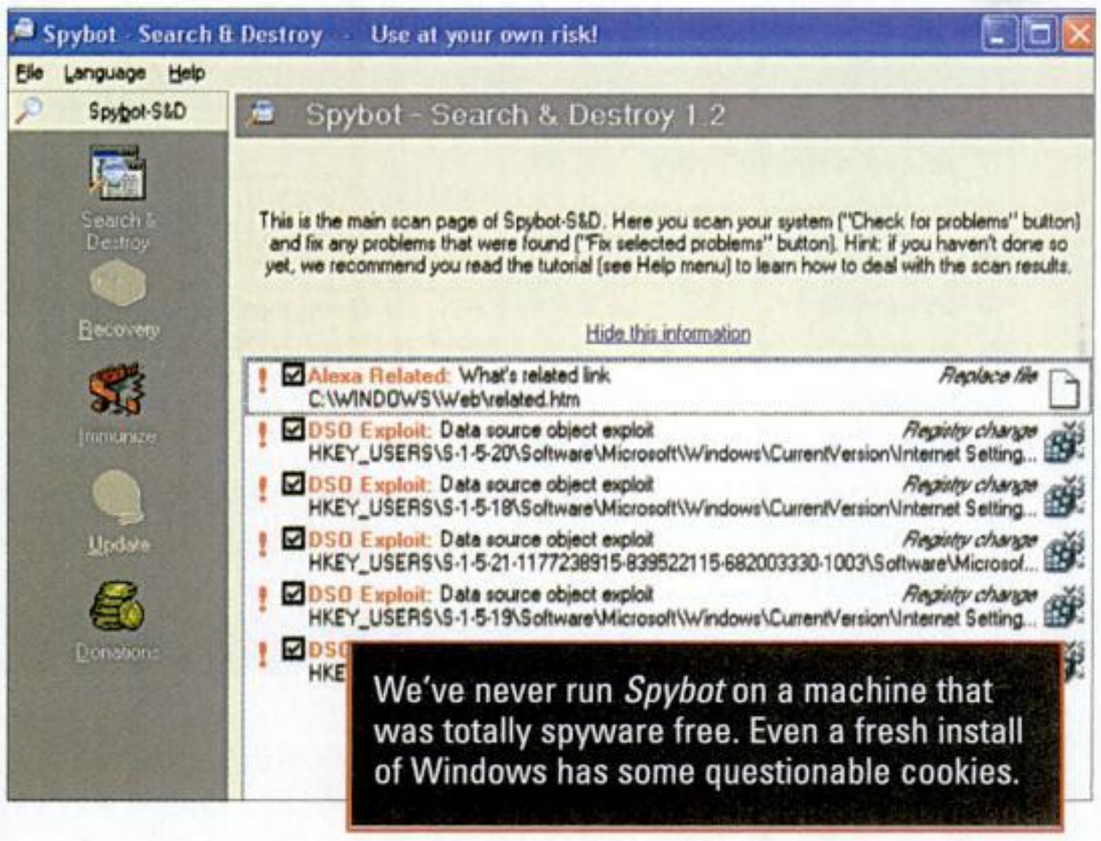
Most spyware apps don't do anything particularly egregious; they may simply send a list of recently visited web sites to an online marketer. Others may be much more annoying, resetting your home page URL, for example. Spyware has also been known to steal a user's CPU processing cycles for a distributed computing project, and the worst offenders will steal your personal information and send it over the net to some scum-bite in the Ukraine.

Spy programs are sometimes hidden in file-sharing apps that you voluntarily install, but they can also be installed without your knowledge when you visit a seedy web site, or when you open an e-mail attachment. Spyware isn't easy to get rid of once installed, but *Spybot Search & Destroy* is free, and will eradicate most of the spookiest crap. The utility works much like an antivirus program, comparing known spyware listed in a definition file to the apps running on your PC. Should it detect any spyware, it digs deep into your filesystem and removes every trace of the offending code. *Spybot* also removes the cookies that large ad banner companies attach to ad banners and use to track your browsing habits.

Another handy extra included with *Spybot* is a digital shredder, which overwrites hard drive tracks to make the data stored on them completely unrecoverable. This means that if you have any files you want to permanently remove from your machine, the shredder will overwrite the files with random data as many times as you specify.

Once you've cleaned all the spyware from your PC, *Spybot* will immunize your system from reinfections, and by regularly running *Spybot*, you can keep your rig clear of any new unwanted apps that the malcontents may develop.

http://security.kolla.de **FREE**

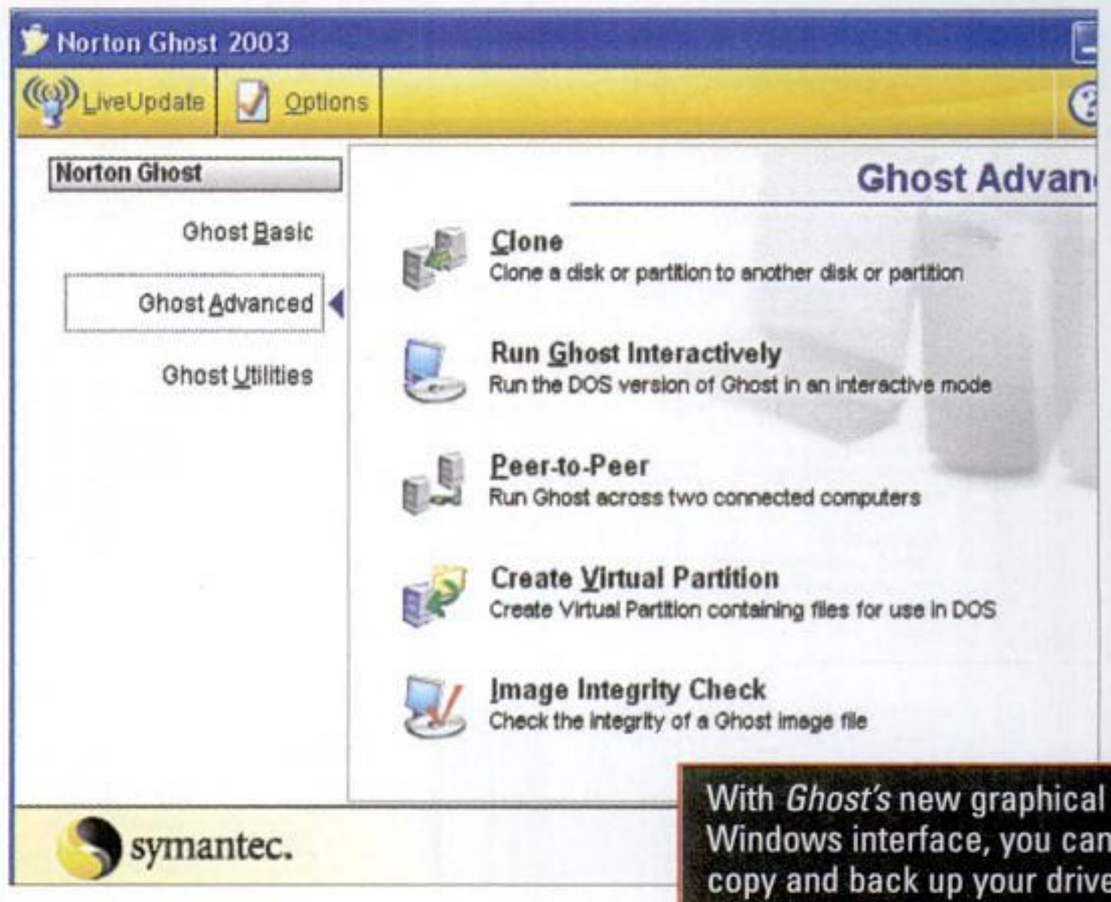


We've never run *Spybot* on a machine that was totally spyware free. Even a fresh install of Windows has some questionable cookies.

ALSO CONSIDERED...

Lavasoft's *Ad-Aware* (**www.lavasoft.nu**) performs many of the same functions as *Spybot Search & Destroy*, but the free version of *Ad-Aware* lacks some of *Spybot's* important features. In order to block ActiveX installers, one of the primary vectors of spyware infestation, you have to upgrade to the *Plus* version. So, for the price (free), *Spybot* simply can't be beat.

HARD DRIVE IMAGING



With *Ghost's* new graphical Windows interface, you can copy and back up your drive with three easy clicks.

Norton Ghost 2003

We're big fans of drive imaging technology in the Maximum PC Lab. Sure, we burn regular backups of all our most important files to DVD and CD, but drive imaging utilities allow us to make perfect clones of entire hard drives. This is a godsend during benchmarking because it allows us to run our tests on perfectly clean system builds. Drive imaging programs take a snapshot of the exact state of a hard drive, then save the snapshot to a file on another hard drive or piece of media.

Norton Ghost is a DOS app with a Windows shell. While you're in Windows, you tell *Ghost* which disk partitions you want to create an image of, and which drive you want to store the image on. Your machine then reboots into a special version of DOS, where *Ghost* runs the tasks you requested. You can save the image to any other hard drive in your system, to any USB or FireWire hard drive, and to media for CD-R, CD-RW, DVD-RW, and DVD+RW drives. You can even save the image to a hard drive on another computer on your network. None of the other imaging programs we tested gave us this many options. *Ghost* even automatically loads the necessary DOS drivers for your optical burners, USB drives, FireWire drives, and network drives.

In our disk image creation and restoration tests, *Ghost* turned in the second-fastest imaging times, taking 8:15 (min:sec) to create an image file from a partition, and 3:23 to write that image back to the source partition. Also, the final image file was slightly smaller than those created by the other programs.

Ghost can also simplify migration to a larger hard drive. All you need to do is connect both drives to your system, select a disk-to-disk copy, and let it ride. *Ghost* will even expand an existing partition to fill the extra space on a new drive. We tested the stand-alone version of *Ghost*, but it is also available in *SystemWorks 2003 Professional*.

www.symantec.com **$70**

ALSO CONSIDERED...

We also tested *Drive Image 7.0* and *Acronis True Image 6.0*. *Drive Image 7.0* was a big disappointment. It requires a boot floppy or CD-ROM any time you read or write from the boot drive, and couldn't reliably resize NTFS partitions. *True Image* is a great bare-bones imaging program, and is about $25 cheaper than *Ghost*. But it's also slightly slower than *Ghost* and *Drive Image*.

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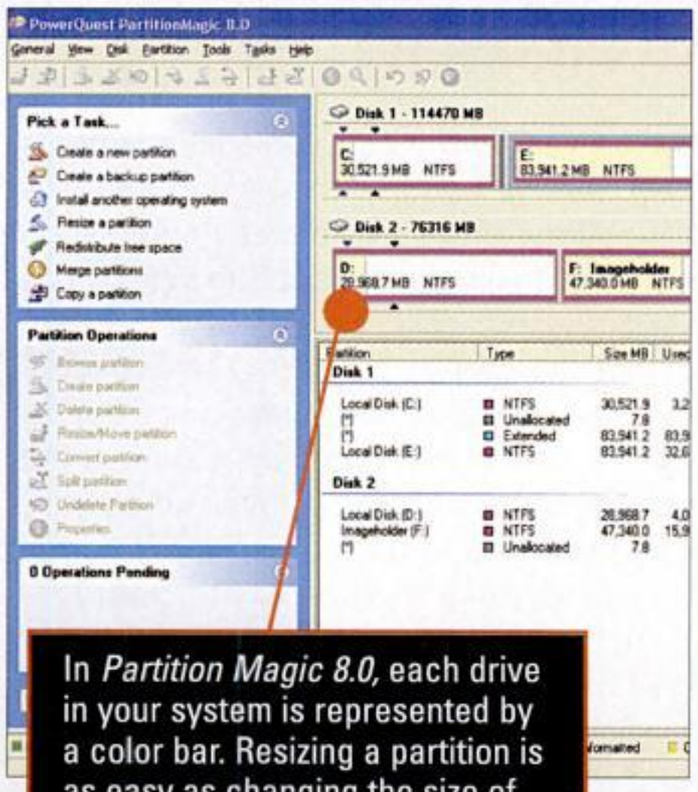
HARD DRIVE MANAGEMENT



In *Partition Magic 8.0,* each drive in your system is represented by a color bar. Resizing a partition is as easy as changing the size of the bar.

Partition Magic 8

Before *Partition Magic* was introduced, the only way to resize one of your hard drive's partitions was to back up all the important data from the drive, wipe all the partitions, then recreate new partitions on the drive. It doesn't seem like much of a hassle, but backing up all your data can be a time-consuming task. *Partition Magic* changed all this, by letting you move, resize, and reorganize your drive's partition structure while keeping the data on the drive.

Partition Magic 8 is the latest in a long series, adding full support for Windows XP and the new version of NTFS that comes with it. The basic functionality of *Partition Magic* remains the same as previous versions—you can resize, move, copy, format, or delete partitions using a simple Windows interface. If you're not modifying your C: drive, *Partition Magic* locks access to the drive you want to change and immediately makes the changes, right in Windows, usually without a reboot. If you need to resize the C: drive, *Partition Magic* reboots your PC, and makes the changes to the drive during the Windows startup process. The entire scheme is easy and reliable, which is exactly what we want when we're monkeying with data.

www.powerquest.com **$70**

ALSO CONSIDERED...

Acronis *Partition Expert* is a relatively new entrant to the partition-resizing game. But while we like its interface and convenience, we had a couple minor problems with one of our test runs. No data was lost, but we had to run chkdsk to get access to the drive. Not cool.

WINDOWS RECOVERY

ERD Commander

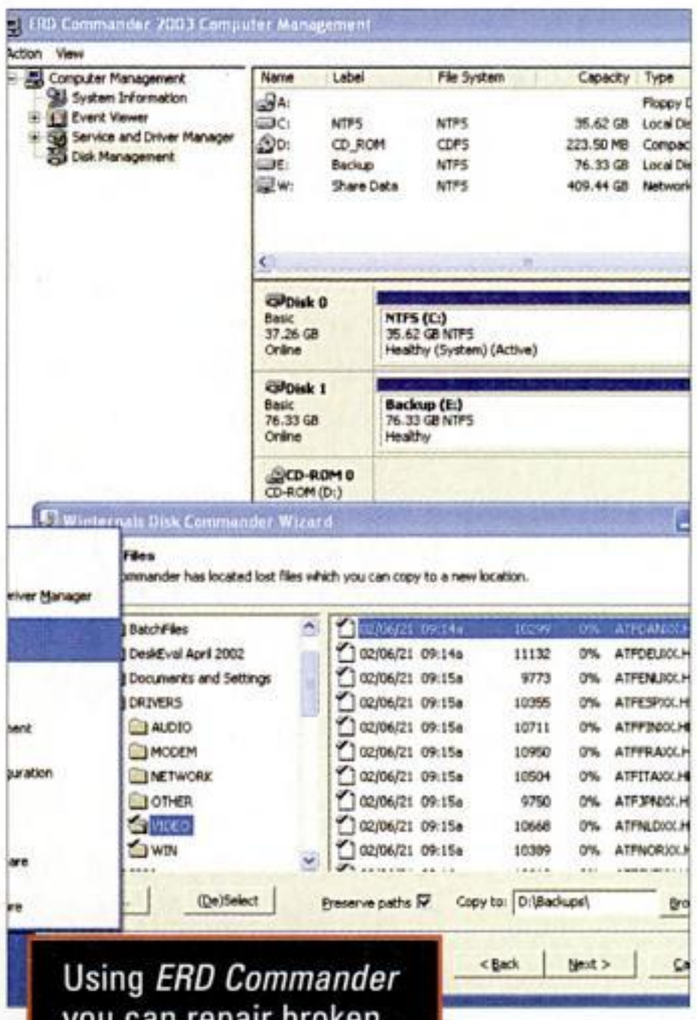
Losing your password in a Windows NT-based operating system, such as Windows 2000 and XP, is a hassle. And if you lose your Administrator password, you're hosed. Unless, of course, you have *ERD Commander.*

ERD Commander—ERD is short for Emergency Rescue Disk—is a CD-ROM-based boot disk for all NT-based operating systems. It includes vital utilities that can recover lost files and damaged data from hard drives, and reset the Administrator password for a system—*even if you don't know the original Administrator password!* Hopefully, you'll never need this utility, but when you do, it will save you loads of time.

Resetting a lost password really doesn't sound that exciting to someone who has never gone through Microsoft's official lost password routine. The official way to reset a password in WinXP is to install a second copy of the OS to the same hard drive, then use the second, working copy of the OS to back up the data you need. After that, you do a complete format of the drive, install Windows *again*, and then restore your data. *ERD Commander* sounds much more impressive now, doesn't it?

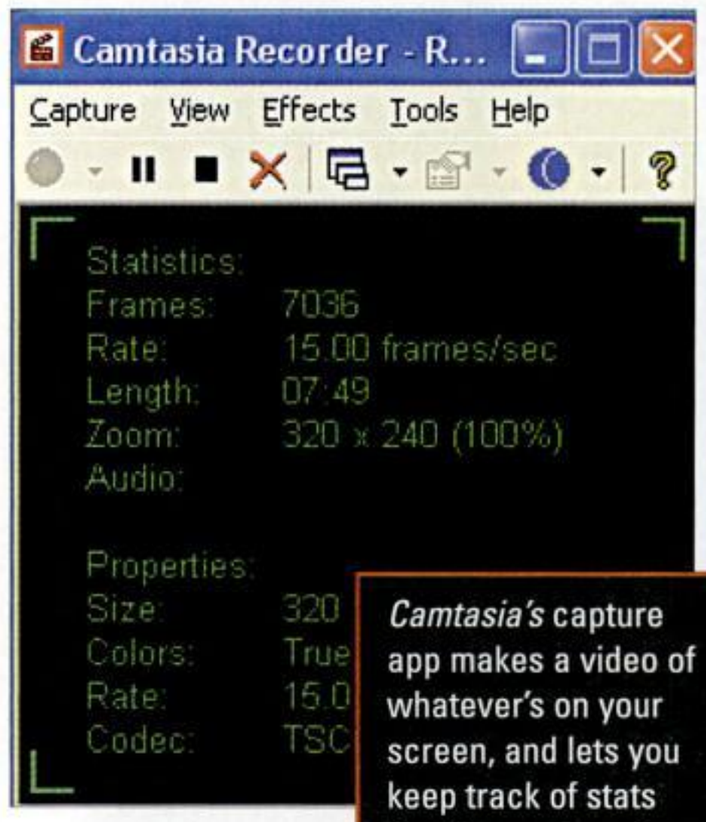
There are two pricing plans for *ERD Commander:* a version that's good for five days and costs $200, and a full version for use on up to 100 machines that costs $600.

www.winternals.com **$200/600**



Using *ERD Commander* you can repair broken hard drives or recover deleted files.

SMACKDOWN CAPTURING



Camtasia's capture app makes a video of whatever's on your screen, and lets you keep track of stats like the number of frames captured and the frame rate of the video.

Camtasia

You just smeared a fellow fragger in an online deathmatch, but you and he were the only people around to see it. You can try to describe your smackdown with words and sweeping hand gestures, but wouldn't it be sweeter to permanently memorialize your victory in AVI or MPEG format? If you have a beefy-enough PC, *Camtasia Studio* can record your best gaming moves in just about any game.

Camtasia is ostensibly used for the creation of tutorial and product demo videos, but we think it's extremely cool to make gameplay videos on just a single machine. But make no mistake, you need to have a monster machine for this to work well. We used a 3GHz Pentium 4, 512MB of RAM, and a GeForce 5900 Ultra, and had to turn the resolution in our games way down to get both a playable frame rate in-game, and a decent frame rate in the video. We had our best results when we used in-game demo-recording functions to save our in-game antics, then recorded the demo playback with *Camtasia.*

If you just need to record your Windows Desktop—a demo on using *Photoshop,* for example—*Camtasia* gives you loads of options. You can record what happens across the entire desktop, in just one application, or in just a portion of your screen. Sure, not everyone needs a screen-grabbing utility that will capture video. And, yes, *Camtasia* is expensive if you're just looking for bragging rights. But when your buddy tries to claim that you lucked out when you fragged his ass, the video proving him wrong will make it all worthwhile, won't it?

www.techsmith.com **$350**

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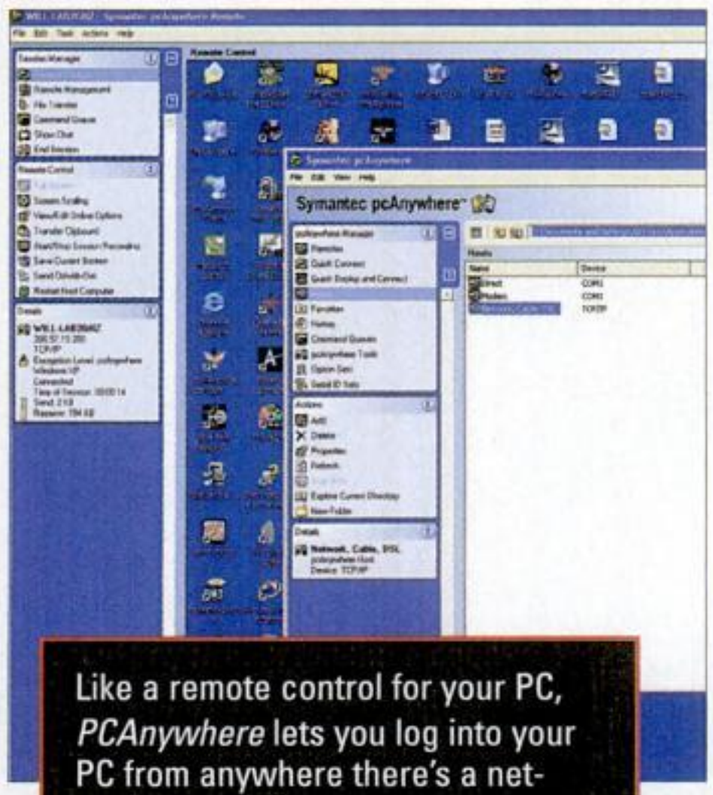
REMOTE ACCESS



Like a remote control for your PC, *PCAnywhere* lets you log into your PC from anywhere there's a network connection.

PCAnywhere 11.0

Whether it's to admin a server in Kraplakistan from afar, or just grab a file or two from your desktop, everyone needs to remotely control a PC on occasion. Enter *PCAnywhere 11.0*.

This utility lets you log into your PC using either a serial or parallel cable, or a network connection. To get started, you need to install the host program on the machine you intend to connect to, and the *PCAnywhere* client on the machine you want to connect from. Once the software's installed, you need to configure the host. You can adjust everything from the encryption used to protect the session, to the types of connections that are allowed. But the real fun starts once you connect to the remote PC.

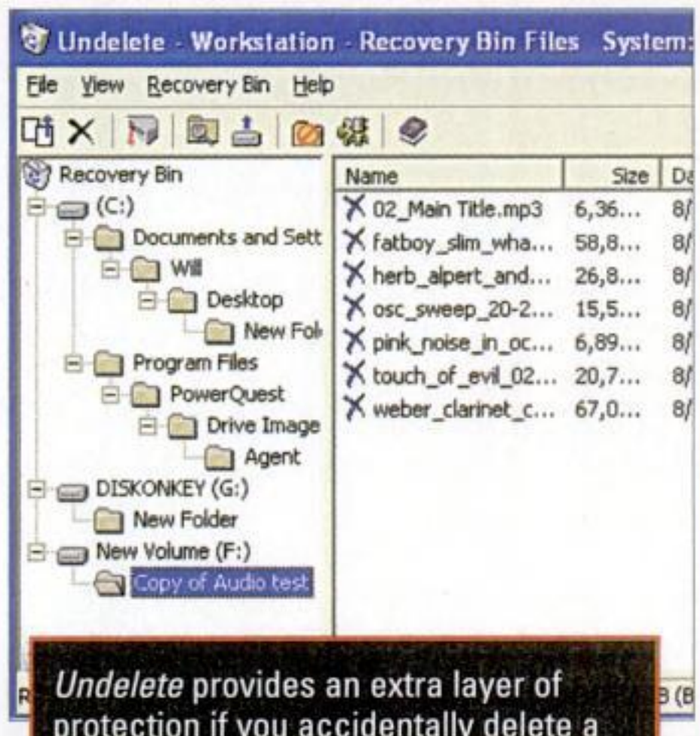
When the client and the host are configured properly, and you're connected, using *PCAnywhere* feels exactly like you're sitting at the remote PC. You can run applications, browse the hard drive, transfer files between the host and remote PCs, kill frozen apps, and even restart the system. With *PCAnywhere,* you can do anything remotely that you can do when sitting at the mouse and keyboard.

www.symantec.com **$200**

ALSO CONSIDERED...

If you're not an IT weenie, and don't know the difference between an LDAP server and L-Dopa, Windows XP Pro comes with the JV version of *PCAnywhere* built in. Remote Desktop lets you connect to your PC over the network, just like *PCAnywhere*, but it isn't as configurable.

FILE RECOVERY



Undelete provides an extra layer of protection if you accidentally delete a file. It will even protect files on removable disks.

Undelete Home

The Windows Recycle Bin is supposed to protect files you delete from truly being deleted. But if you've ever tried to use the Recycle Bin to recover a crucial lost file, you've already discovered that the Recycle Bin in fact protects only some files that are deleted. The list of exceptions is long. Files on removable drives and network drives aren't protected in Recycle Bin, for instance. And if you overwrite a file, the original is forever gone. If you hold down Shift when you press the Delete key, that bypasses the Recycle Bin as well. Finally, if you empty the Recycle Bin manually, whatever was in there is no more.

Undelete fills all Recycle Bin's holes. It can recover files that you delete from removable drives, as well as other files that have been permanently deleted from the hard drive, whether intentionally or accidentally. You can even recover some files that you accidentally overwrite. Unfortunately, you can't recover files that you delete from a network share unless the server is running the server-version of *Undelete*. The utility works best if it's able to track your deletions, but it also includes tools to help you recover files you deleted before the program was installed.

Undelete works exactly as advertised, but we can't give it a wholehearted recommendation. A careful user should never need this program. But users who frequently find themselves deleting files they need might find a home for *Undelete*.

www.executivesoftware.com **$30**

UNINSTALLING

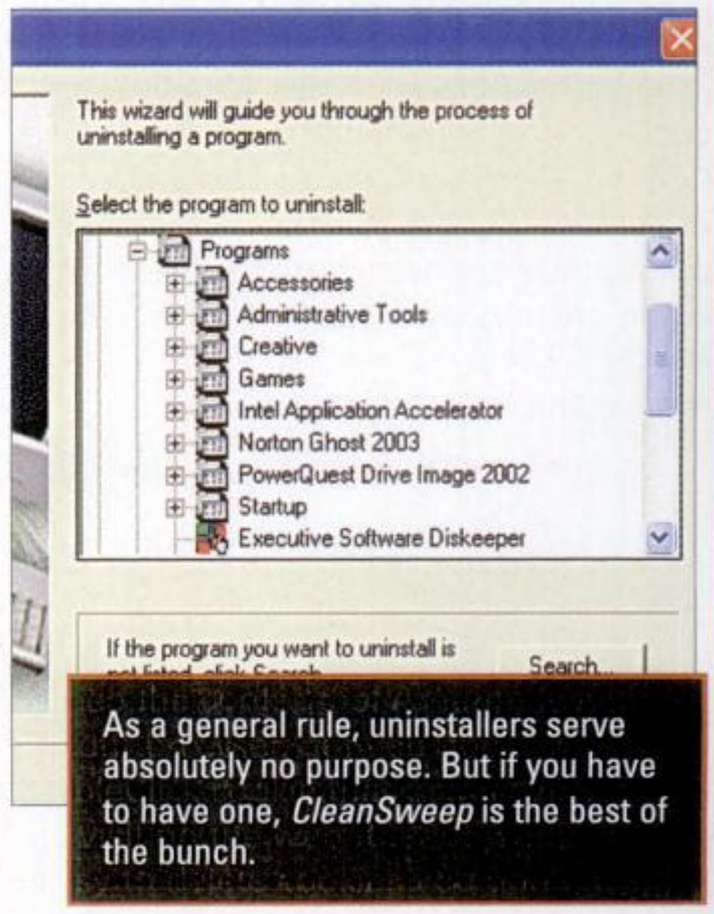
CleanSweep

Norton's *CleanSweep* works as advertised, but we don't see any need for stand-alone uninstall utilities anymore. The uninstaller that's built into WinXP works reliably, so *CleanSweep* is rather unnecessary, even if it does remove all traces of uninstalled applications from a PC. WinXP's uninstaller may leave behind a few harmless Registry keys and save files, but if you're running a 180GB hard drive (and you should be), who cares?

That said, *CleanSweep* distinguishes itself from the tools integrated with Windows by managing all the tiny files your web browser accumulates. The small cookie files that web sites leave behind are a perfect example. You want to keep the cookie that Amazon leaves on your browser, but you don't want the DoubleClick cookie that tracks every site you visit on the web. *CleanSweep* makes it easy to delete cookies you don't need, and keep cookies you want. (Of course, we'd much rather have a program that prevents malicious sites from loading cookies on our machine in the first place; deletion after the fact is an inefficient solution to the problem).

The other features that *CleanSweep* offers are ho-hum. The "Safe and Fast Sweep" feature does the same thing as Windows Disk Cleanup tool: Clears your browser cache, empties the Recycle Bin, and deletes files in your temporary directories. And because the Windows installer will compress infrequently used files, the Windows Disk Cleanup tool is actually more effective than *CleanSweep*.

www.symantec.com (only available as part of *SystemWorks 2003*) **$70**



As a general rule, uninstallers serve absolutely no purpose. But if you have to have one, *CleanSweep* is the best of the bunch.

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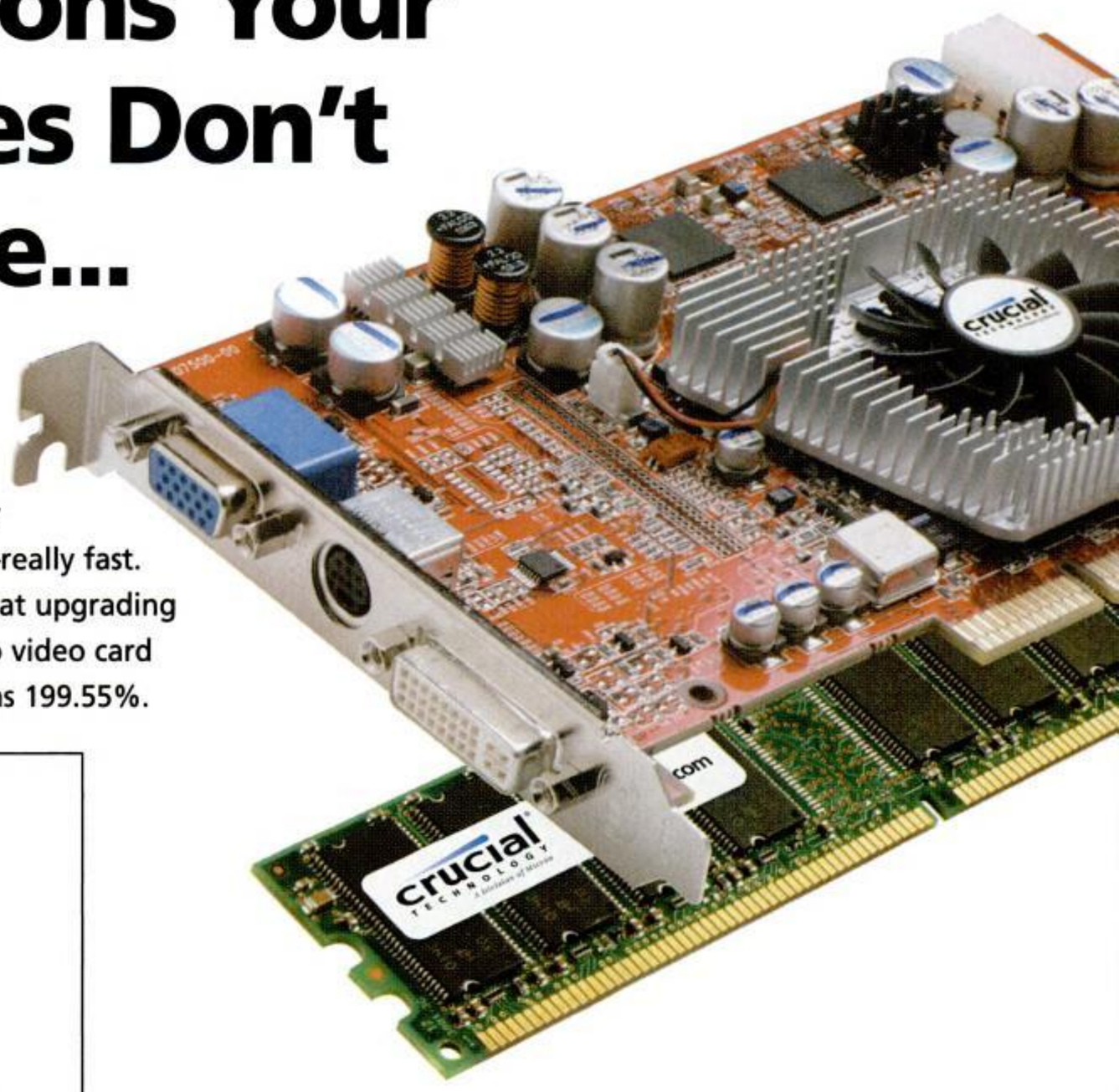
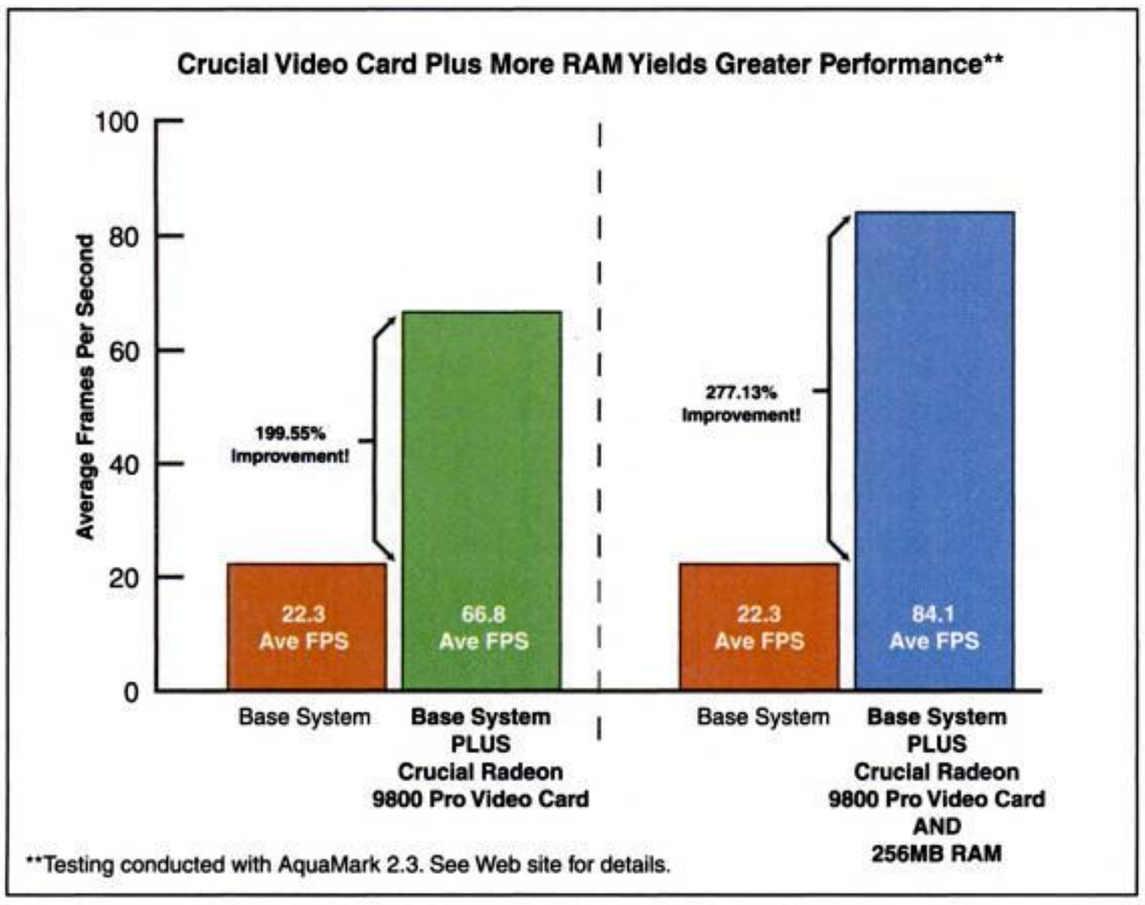
Two Secret Weapons Your LAN Party Buddies Don't Want You To Have...



New tests reveal the power of this killer combo!

Okay, the first "secret" isn't really so secret. You probably know very well that the Crucial Radeon™ 9800 Pro video card is fast—really fast. In fact, tests conducted by the Crucial Performance Lab show that upgrading from a GeForce2 GTS 32MB card to the Crucial Radeon 9800 Pro video card can improve average frame rate benchmark scores by as much as 199.55%.



**Testing conducted with AquaMark 2.3. See Web site for details.

The second secret revealed!

But the tests showed something else. Something so subtle, we're embarrassed to say we almost missed it. According to the tests, maximum performance can be achieved by upgrading *two components at the same time*—the video card and the RAM. With the Crucial Radeon 9800 Pro video card and an additional 256MB of RAM, our test system showed a 277.13% improvement over the base system in average frame rate benchmark scores.

So now you know. Upgrade your video card to a Crucial Radeon 9800 Pro and get a big boost in performance. Throw in some more RAM while you're at it, and get a bigger boost in performance. Now that's a killer combo your LAN party buddies will be drooling over!

Build your own killer combo.

- ✔ 100% compatibility guarantee
- ✔ Free technical support
- ✔ Limited lifetime warranty

Factory-direct quality and savings!

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256MB PC2700 DDR	As low as	$51.99
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256MB PC3200 DDR	As low as	$54.99
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http://**promo.crucial.com** keycode: **3max**

or call toll-free 1-888-363-5154 to talk to a memory advisor.

*See Web site for details.

Prices may vary according to specific system requirements. The price listed was valid on 8/8/03 when we sent this ad to the publisher; however, prices may have dramatically increased or decreased since then. Visit the FAQ section of Crucial.com to learn more about why memory prices go up and down.

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Norton SystemWorks 2003 Professional

All-in-one utility suites are a quick fix, but are they effective?

Even if you aren't a hardcore PC tweaker, you still need to run some basic utilities. The rapid proliferation of the Blaster worm in August proved that *everyone* needs antivirus software to keep unpleasant code from running rampant on a PC, but other utilities are just as important. A good hard drive defragmention can give your system more of a performance boost than some hardware upgrades, and everyone needs a disk imaging program to make regular backups.

So it's agreed: A well-stocked software toolkit is essential. But instead of buying individual boxed copies of each utility, can't we just purchase an all-in-one suite, such as *Norton SystemWorks 2003 Professional?* What do we get with *SystemWorks*—and what do we sacrifice?

The latest suite version includes *Norton AntiVirus 2003, Norton Utilities, Norton CleanSweep, GoBack Personal Edition,* and *Ghost.* We've already gone into great detail about *AntiVirus*, *CleanSweep*, and *Ghost*, so we won't repeat ourselves. The versions of the three apps that are included with *SystemWorks* are virtually identical to their non-bundled cousins. The only difference is that the *Pro* version of *AntiVirus*—reviewed on page 28—includes two licenses, while the bundled version should only be installed on one computer.

The centerpiece of *SystemWorks* is *Norton Utilities,* a collection of handy PC maintenance tools. None of the utilities are absolutely vital for normal PC users, but they can save you a lot of trouble in a pinch. Here's what you get:

- *Disk Doctor* is a much-improved version of the chkdsk disk repair app that ships with Windows. When an overclocking attempt goes awry, you can use *Disk Doctor* to fix hard drive corruption that chkdsk can't repair.

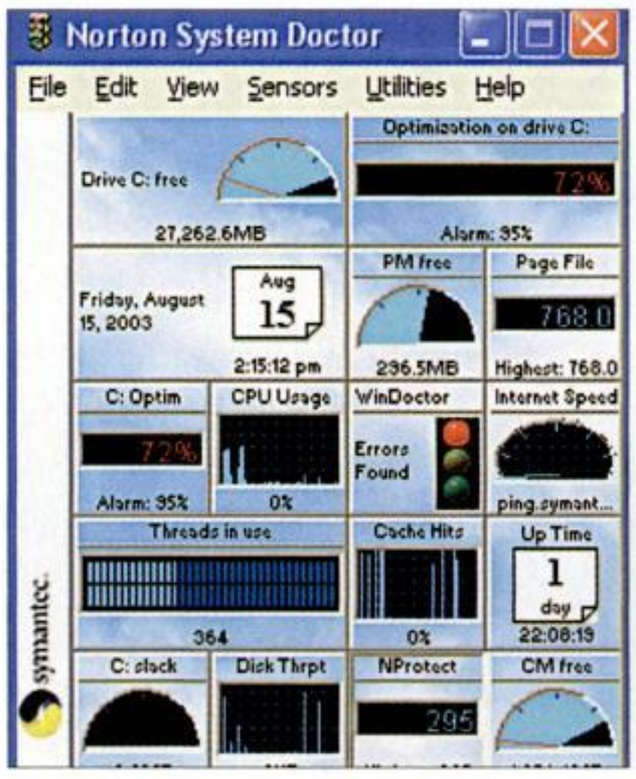
- *Speed Disk* defragments your hard drive. It doesn't include all the fancy scheduling options or boot-time defragmentation that *Diskeeper* does, but it's good enough for most non-power users.

- *System Information* ferrets out and reports on all the relevant details about your system, component by component. You can find details on everything from the BIOS version currently loaded on your PC to the maximum resolution your printer supports.

- The Unerase Wizard is *Undelete Lite.* It protects files on your system from accidental deletion, but doesn't offer the same protection for removable drives.

- *WipeInfo* is a shredder for documents stored on your hard drive. Drop an unwanted file in the program and it will erase it from the hard drive using techniques approved by the Department of Defense.

- *System Doctor* pulls all the utility apps together and gives you a handy diagnostic tool for your PC. You can monitor the fragmentation level of your drives, the amount of free memory available, the time since your PC's last reboot, and even the status of your virus definitions.



The *System Doctor* applet keeps tabs on the current state of your system, and alerts you when something requires your attention.

The whole package sounds like the best thing since home-made beer, but *Norton Utilities* isn't the end-all, be-all. The *WinDoctor* program purports to remove extraneous entries from your Registry, remove invalid or unused shortcuts from your drive, and clean up the kruft that Windows apps scatter across your hard drive. Unfortunately, on one of the machines we tested, *WinDoctor's* recommended "fixes" rendered Windows unstable and unreliable. It's not a big enough problem to make us dismiss *SystemWorks* wholesale, but we won't run *WinDoctor* on a machine ever again.

Another app of dubious value is *GoBack Personal Edition. GoBack* is a pumped-up version of the Windows System Restore tool. It saves drivers, applications, and other important system files and can roll your system back to a previous state in case of a serious bugaboo. That's just peachy, but because *SystemWorks* includes *Ghost*, we'd rather just make our own occasional drive images, and then perform our own "clean starts." Unless you have multiple hard drives in your system, and your *GoBack* data is saved on a hard drive other than your main one, *GoBack* will only protect your system from software problems, not a hard drive failure.

SystemWorks also fares pretty poorly on the security front. While it includes our current favorite antivirus program, it lacks even a rudimentary firewall, a basic necessity for every Internet user. But on the pure utility front, *SystemWorks* does do better. *Ghost* is a great disk imaging program, *Disk Doctor* could save you a lot of trouble, and the defragmenter may not be the best, but it'll get the job done. When you factor in the price—the entire *SystemWorks* Pro package retails for $100 and is usually available with rebates for about $70—*SystemWorks* is actually a great deal. Just don't expect to buy it, slap your hands together, and consider your toolkit complete. *SystemWorks 2004* is just around the corner, so who knows, maybe it will address the 2003 version's short list of problems.

MAXIMUM PC VERDICT **8**

www.symantec.com **$100**

UTILITY BELTS

Antivirus, defrag, backup, and disk repair tools all rolled into one handy package.

MACRAME BELTS

No utility package is complete without a firewall, and some of the features are of questionable value.

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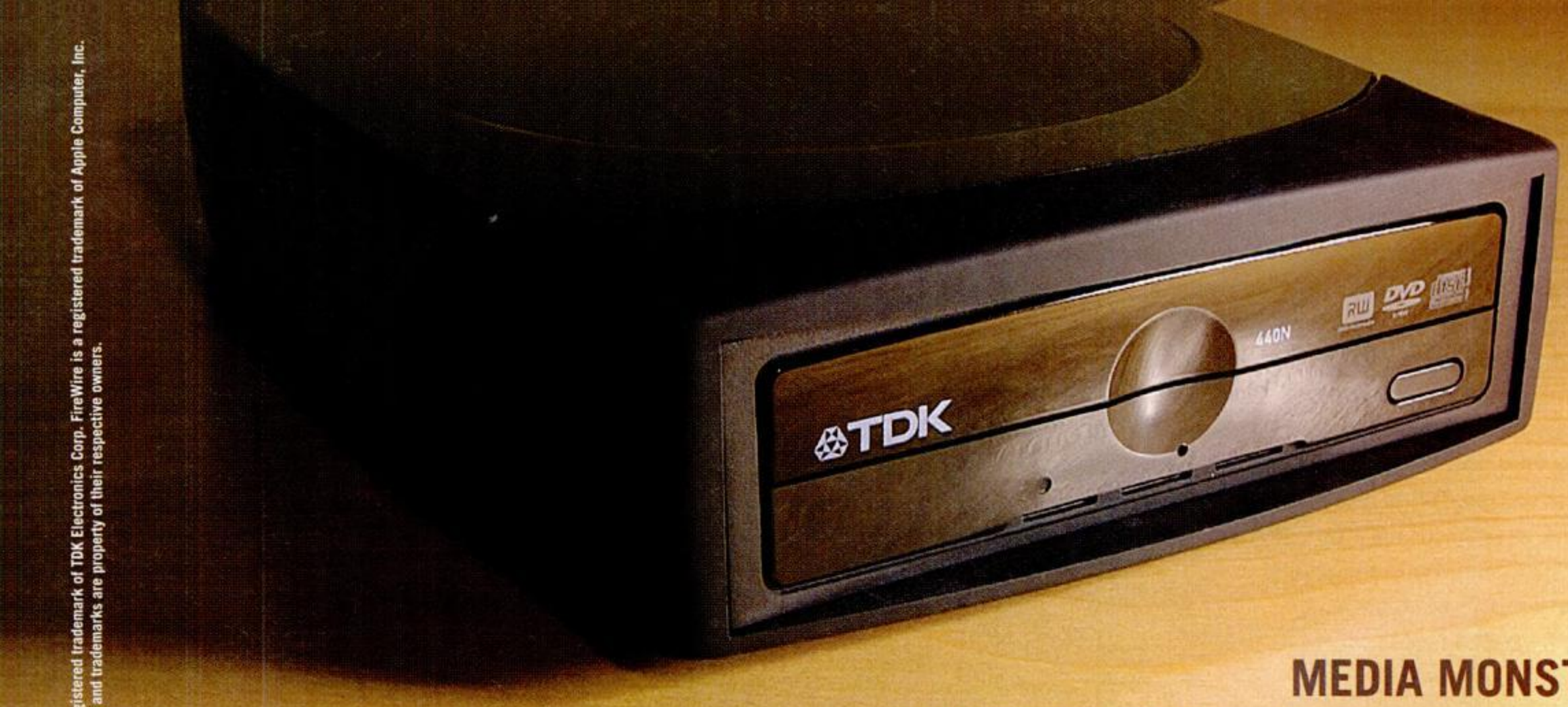

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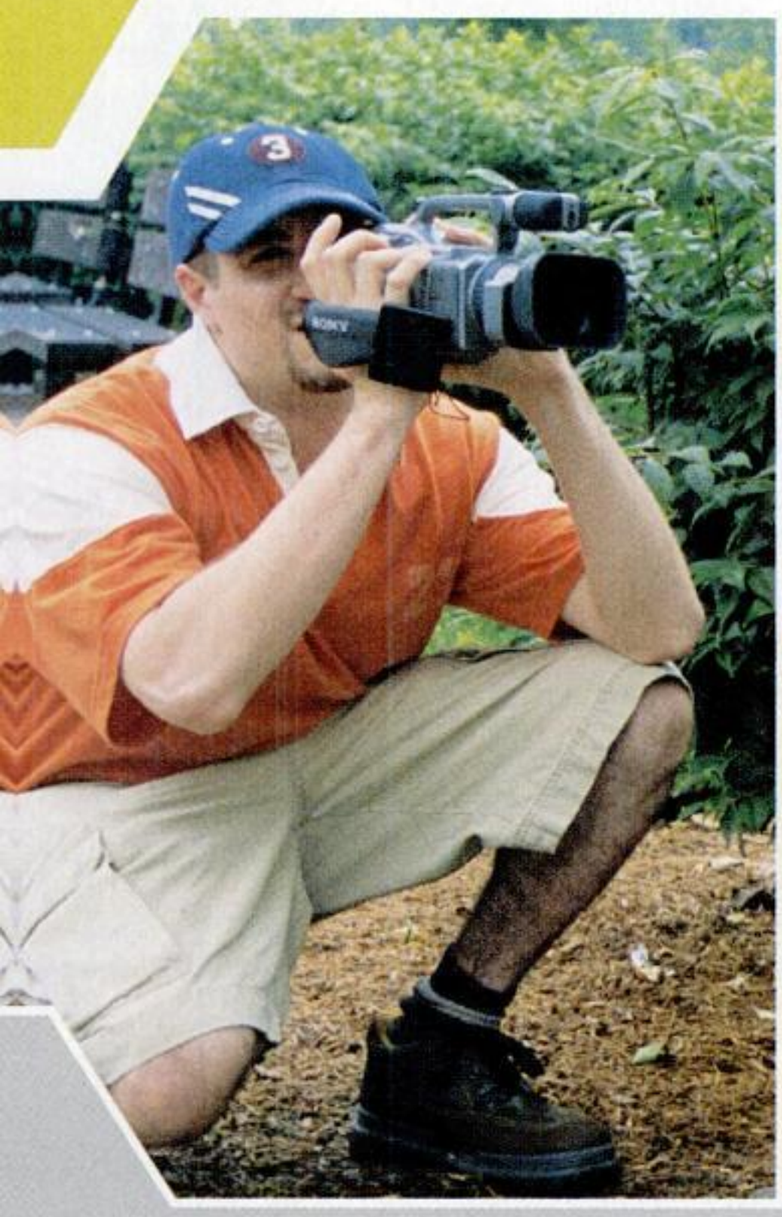

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Portable PC

Take a little piece of your lab along for the ride

We asked one of our editors to bring in his "portable trauma kit" so we could see what tools he brings on tech support house calls. Some of the parts are obvious: a healthy assortment of regular component screws, some motherboard mounting screws, spare I/O shields… some rear panel brackets, jumpers of various sizes, drive mounting rails for ubiquitous Antec cases… power Y-cables, power converters for floppy and serial ATA power, zip ties…a USB floppy drive, a spare mouse and keyboard, some screwdrivers… IDE cables, DVI-to-VGA converters, and even a handy IDE adapter for a 2.5-inch notebook drive. Whew! But there are also a few additional tools that deserve a special highlight.

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PLUG-IN ACCESSORIES PACK These little buggers let you plug LED, switches, and speakers into your front panel headers in the event that you need to run a motherboard outside of the case. You can't find them alone, but they do come with the Senfu Tech Station, which is pretty handy in and of itself.
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ERD COMMANDER This invaluable program creates a boot disk that you can tailor with specific drivers. Once created, your disk lets you boot directly off a CD-ROM into a nice GUI in order to access WinNT, 2000, and XP builds. *ERD Commander* also allows for network access so that you can copy files off an ailing machine. But the coolest feature may be the password reset mode, which allows you to simply change the password in WinXP or Win2000 to what you want.
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Trauma Kit

ZIP LINQ CABLES Unfurled traditional cables can clutter up a toolkit, so Zip Linq cables (which pull out and retract like a handyman's keychain) can save you a lot of room.
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PC POWER AND COOLING POWER SUPPLY TESTER If you go to a friend's home and the power supply looks like it was made from a recycled beer can, you may have just discovered the reason why the system won't boot. This handy PSU tester lets you instantly diagnose a power supply problem in a few seconds. **$10; www.pcpowerandcooling.com**

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RAYTEK MINITEMP You can use this infrared thermometer to quickly check the temperature of your CPU heatsink, the northbridge, hard drives, and other components of note hiding inside your case. It even includes a "laser" to help you more accurately aim.
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ARCTIC SILVER III One of the best thermal compounds on the market. Traditionally used for CPUs, but some hot rodders like to swab a little between the northbridge and its heatsink for extra cooling performance. Good cracker, good cracker! **$7; www.arcticsilver.com**

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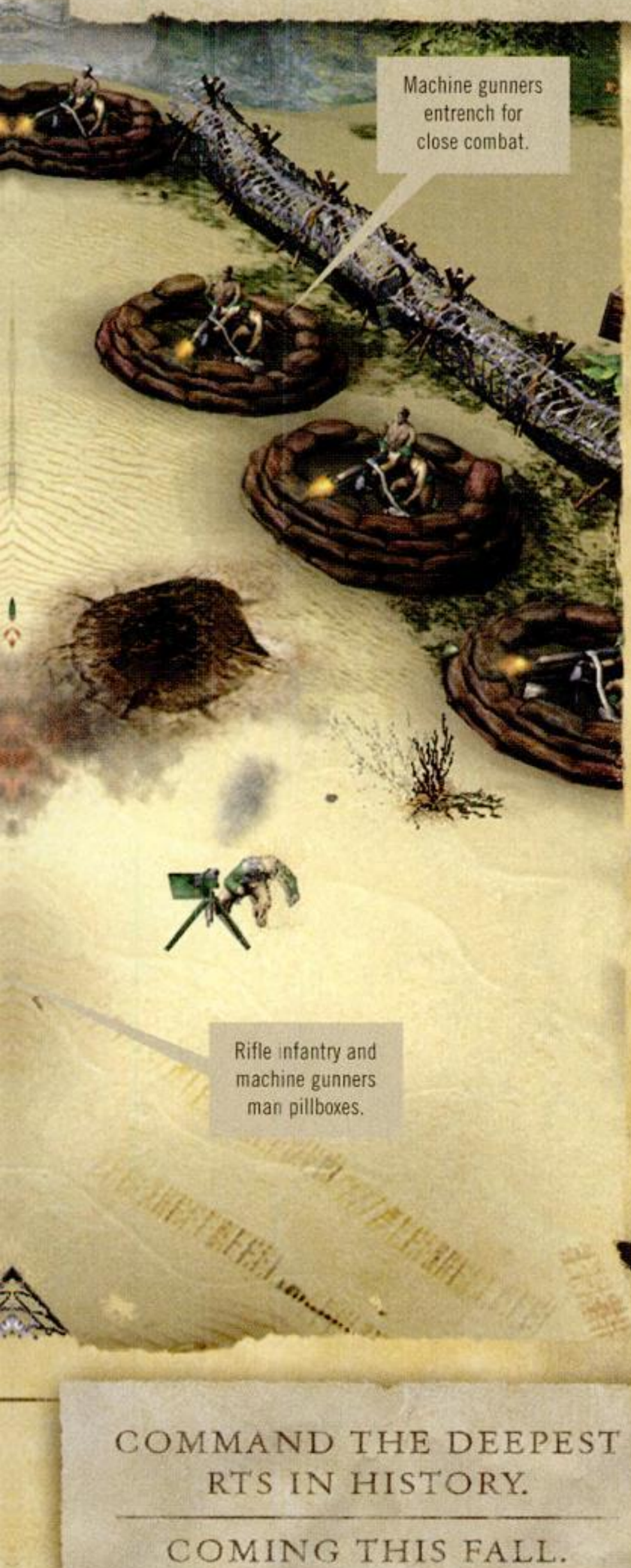

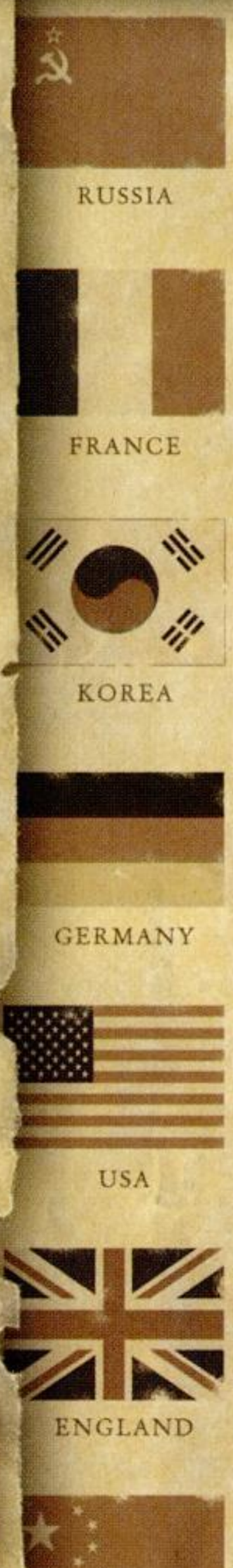

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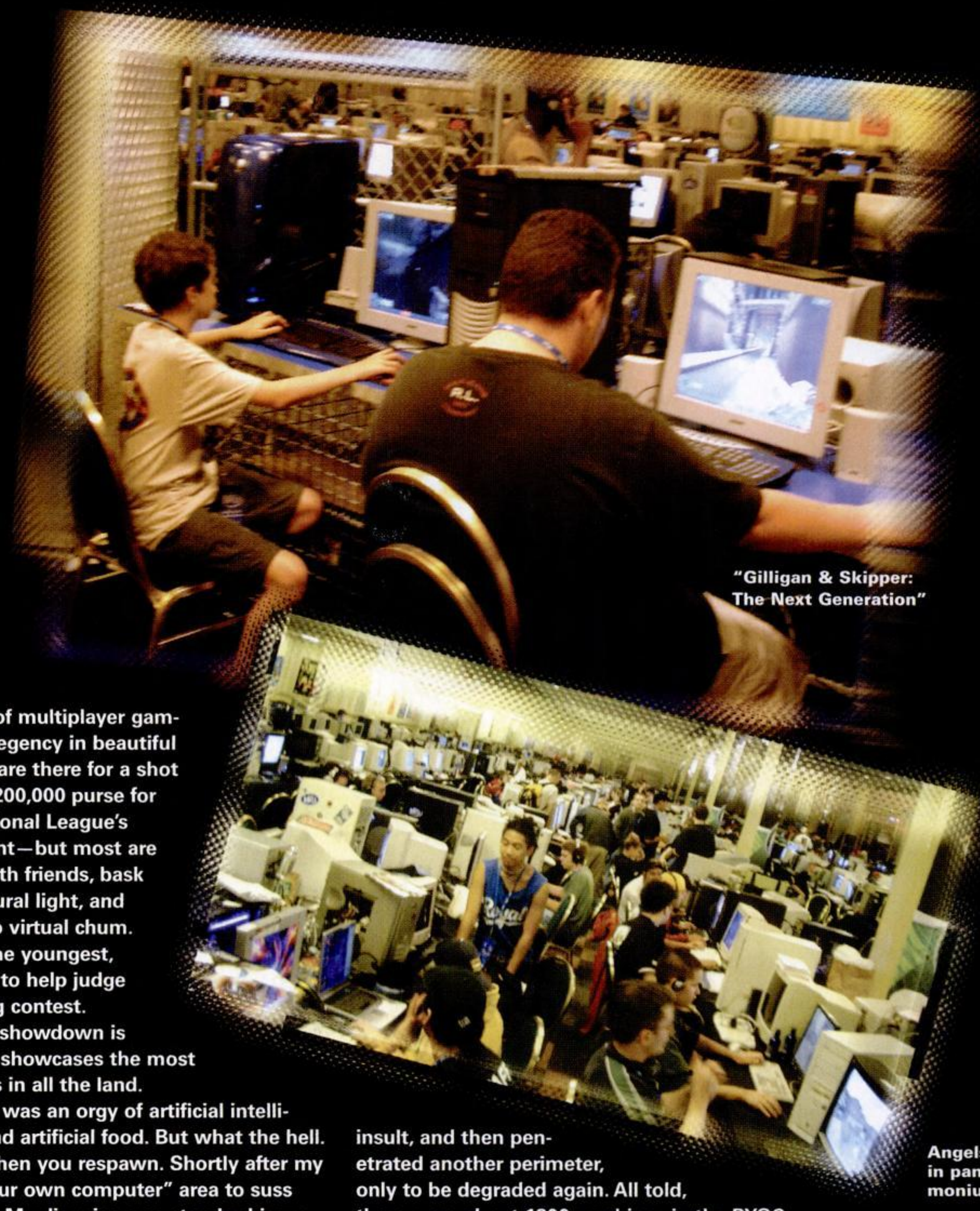
Pilgrim in an UNHOLY LAND

The tale of one editor's journey through the Dark Side of PC modding

BY
WILL SMITH



"Gilligan & Skipper: The Next Generation"

Angels in pandemonium.

Twice a year, thousands of multiplayer gamers gather at the Hyatt Regency in beautiful downtown Dallas. Many are there for a shot at the big money—the $200,000 purse for the Cyberathlete Professional League's *Counter-Strike* tournament—but most are there just to hang out with friends, bask under the glow of unnatural light, and blast virtual enemies into virtual chum. *Maximum PC* sent me, the youngest, most game-savvy editor, to help judge the event's case modding contest. This particular hardware showdown is sponsored by Bawls and showcases the most elaborate home-built PCs in all the land.

Oh, the debauchery! It was an orgy of artificial intelligence, artificial killing, and artificial food. But what the hell. You only live once. And then you respawn. Shortly after my arrival, I hit the "bring your own computer" area to suss out the LAN party scene. My disguise was standard-issue "hardcore gamer"—an original *Doom II* T-shirt and cargo shorts, complete with a Big Grab of Cheetos in hand—but no one was buying it. The first pack of gamers I infiltrated immediately made my disguise. In fact, even before I had asked a single question, I was christened with what would become my permanent handle: "Gramps." I suffered the insult, and then penetrated another perimeter, only to be degraded again. All told, there were about 1200 machines in the BYOC area. Every few hours, Papa John's delivered one metric ton of pizza (or so reported the pizza chain, which delivered more than 1,000 pies during the five-day event), and gaming went on around the clock. For the young folk, that is. My mission was to choose my favorite case mods, and that I did, young whippersnappers, that I did...

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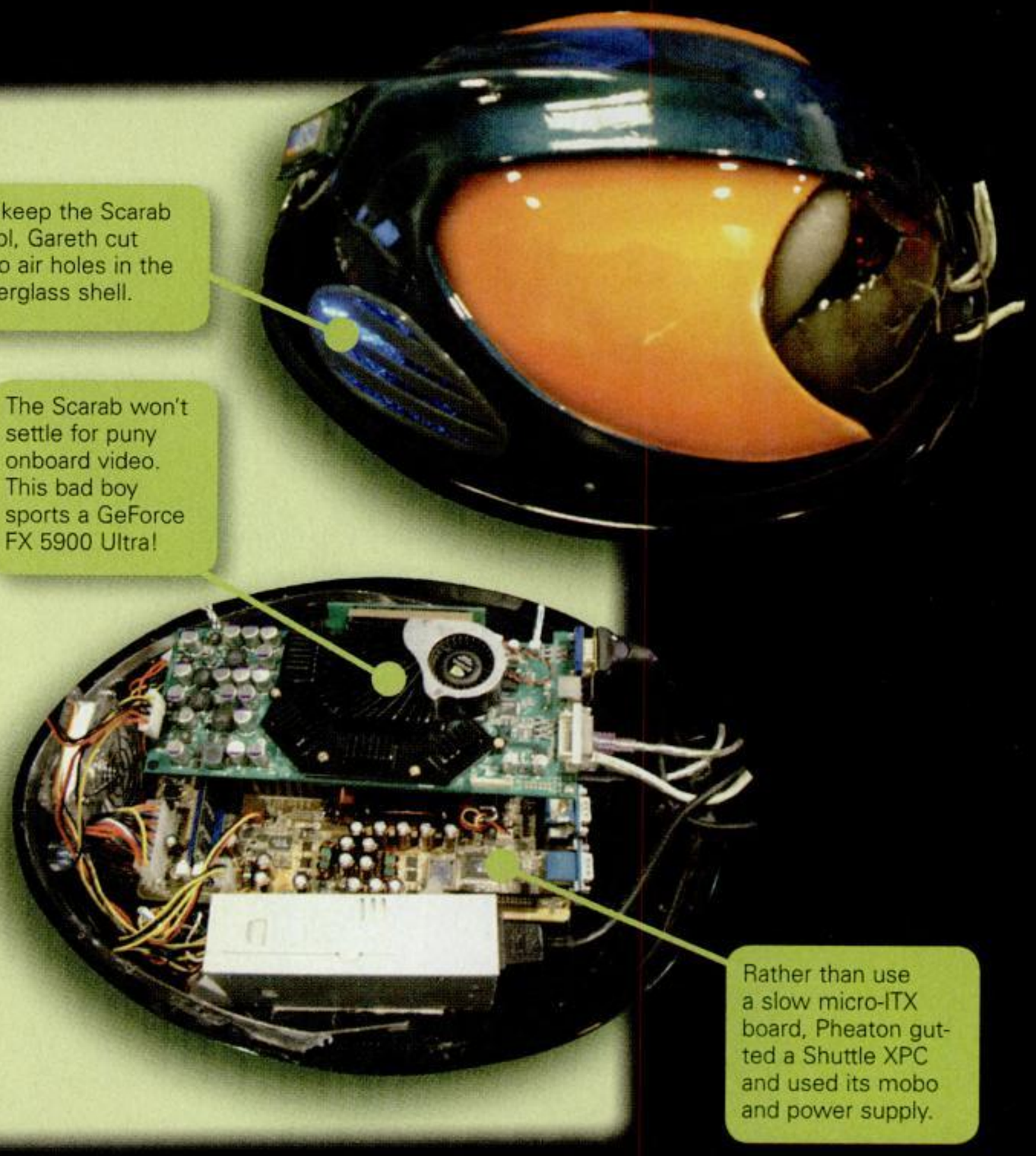
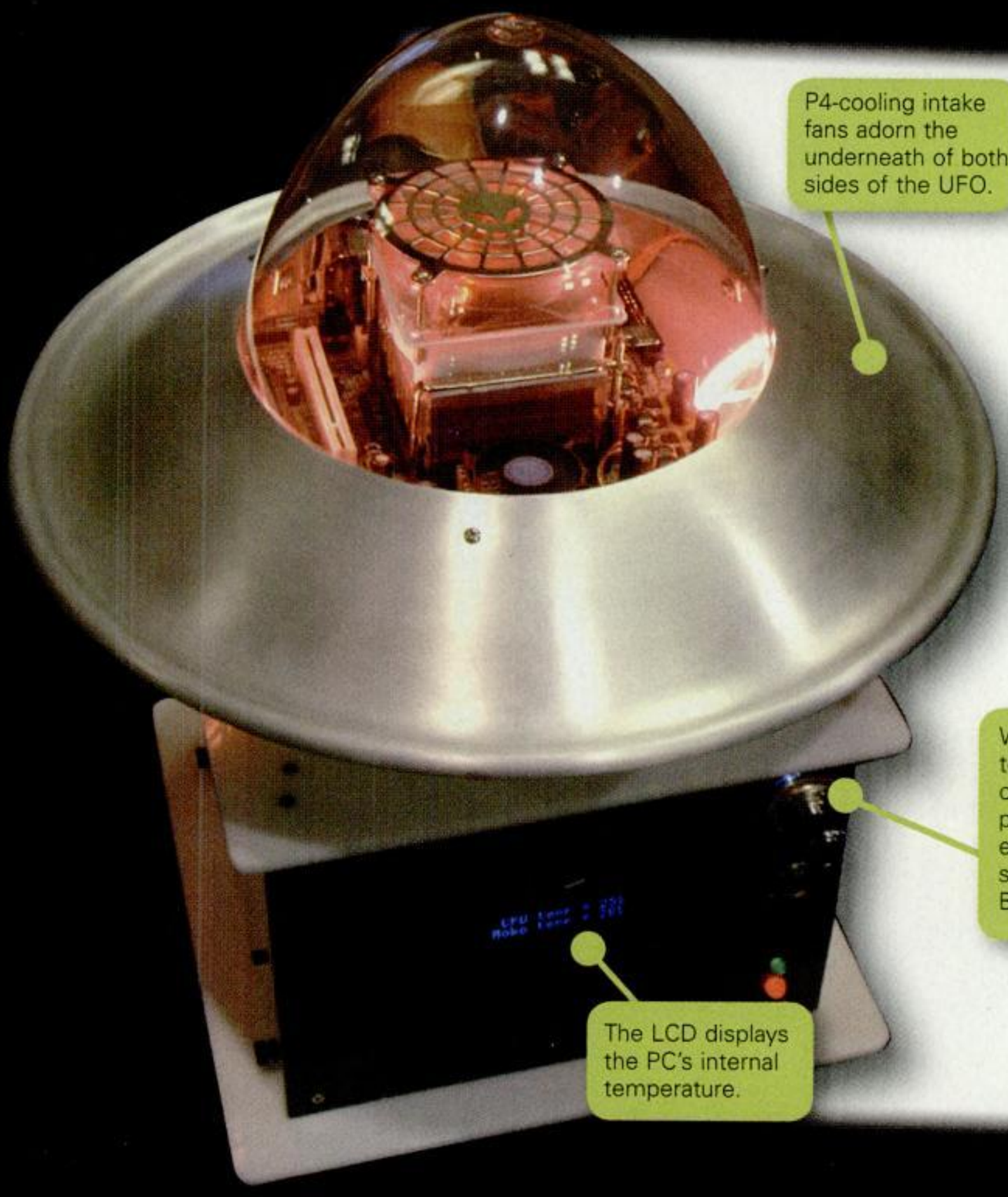
Gareth Powell's "Scarab"

When Gareth, aka Lord Pheaton, commenced work on his latest mod, his goal was to create a case with an organic, fluid shape. First, he sculpted a plastic mold, then used the mold to make a fiberglass shell, reinforcing it with Kevlar strips. The fiberglass/Kevlar combo is strong but extremely light. After the fiberglass set, he took the case to an auto painter, where he applied several different colors of paint, some distress marks to add surface texture, and then more layers of clear coat. From start to finish, the Scarab took about 14 days to build, paint, and assemble. Cost: around $2,000. Not bad for the contest's Second Place winner!





Barry Collins' "UFO Case"

No, it's not a prop from an Ed Wood movie, it's a PC! Taking his cues from sci-fi classics like *The Jetsons* and *Mars Attacks*, Barry Collins converted common household items into this flying saucer. The metallic body of the case is an old cooking wok with its paint stripped off and a hole cut in the lid. The clear plastic dome is the top half of an egg-shaped Easter gift basket. The UFO top is eye catching, but the real work is in the base. The hand-built Plexiglas podium includes two hard drives, the power supply, and a Lite-On DVD/CD-RW combo drive.

Continued ➲

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The desk boasts an AMD rig on the left and an Intel rig on the right. This Belkin KVM swaps the keyboard and mouse between the two systems.

With one monitor up top and one monitor inside the desk, you get double the Windows Desktop in half the space.

A total of six fans wash air over the two PCs before it's forced out at the back.

Behind the second LCD display under the Plexiglas are the dual power supplies that drive the system, and a pair of outflow fans.

Scott Valencia's "Champs Napkin Mod"

In his never-ending quest for more desk space, Scott realized that the best way to recover real estate was to build his two requisite work PCs *into* his desk. So one afternoon at the Champs Bar & Grill, he sketched out his basic design on a napkin, and voila, the Champs Napkin PC was born. Constructed entirely from aluminum, the Champs case holds two full PCs, including up to four hard drives, two optical drives, and two LCD monitors. The clear Plexiglas lid is hinged for easy access to components, and the case features a super-powerful airflow system that sucks air in the sides and blasts it out the back.

Lee Rakestraw's "You Can Take It With You"

The winner of CPL's case-mod contest was "You Can Take it With You," a fully functional PC mounted in a child-size coffin. While the container choice was a little morbid for most *Maximum PC* staffers, no one will deny Lee's fine craftsmanship. Lee mounted his PC in the coffin's lid, and cut a window to show its inner workings, which is all quite remarkable. But he also used a pneumatic air system to open and close both of the coffin's lids and its keyboard tray. The final touches include cold-cathode and LED lighting to give "You Can Take It With You" a spooky vibe. ■

What better way to seal off the lid of a kiddie-size coffin than the diamond plate made popular by rough-and-tumble pick-up trucks?

The actual PC is mounted in the right half of the lid. The left half houses the system's KDS flat panel.

These switches control the coffin's pneumatic air system, which raises and lowers both lids.

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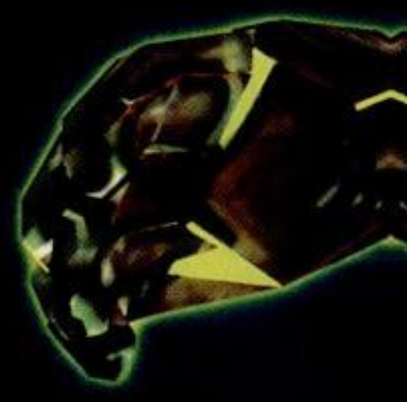

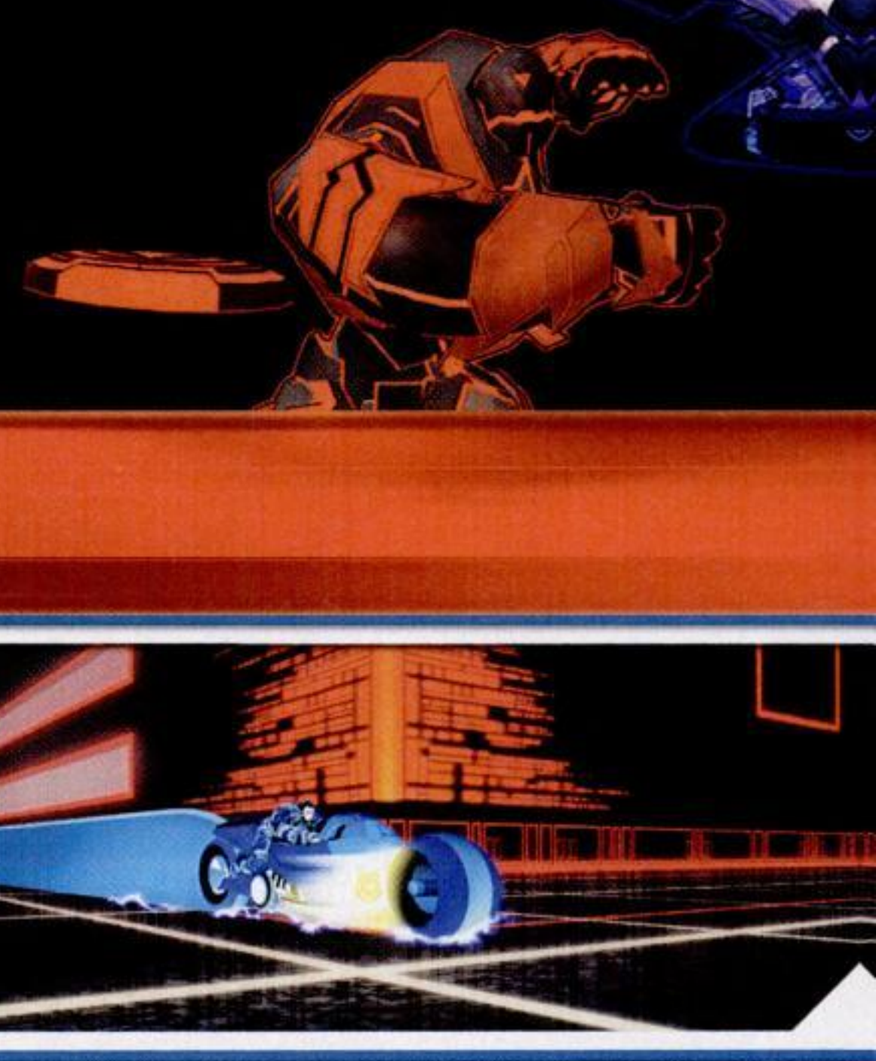

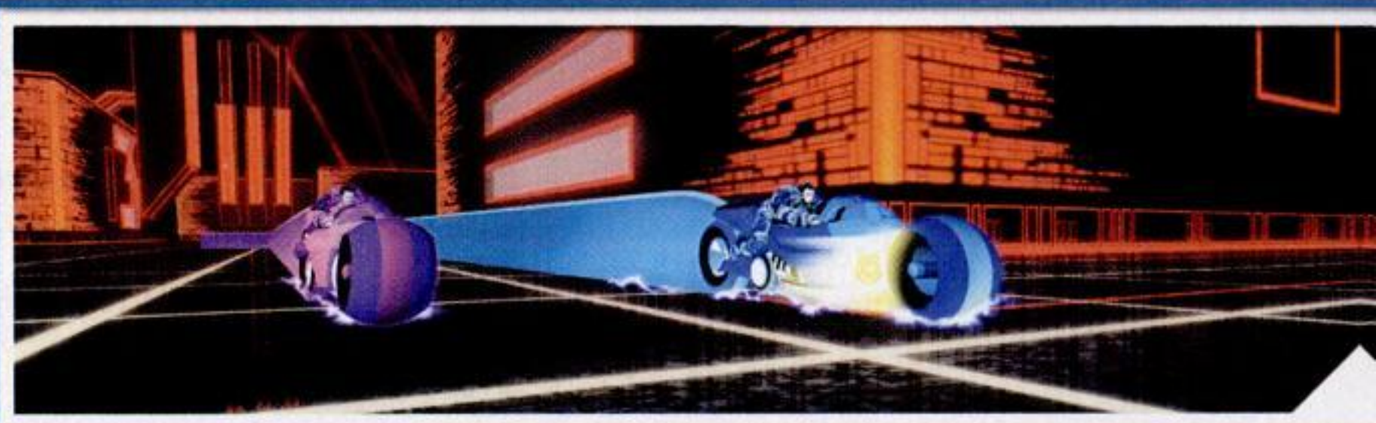

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The hard drive has the most thankless role of any component in your PC. It really only gets noticed when something goes wrong, or when magazines like *Maximum PC* point out that its throughput is the most stubborn bottleneck holding back modern PC performance.

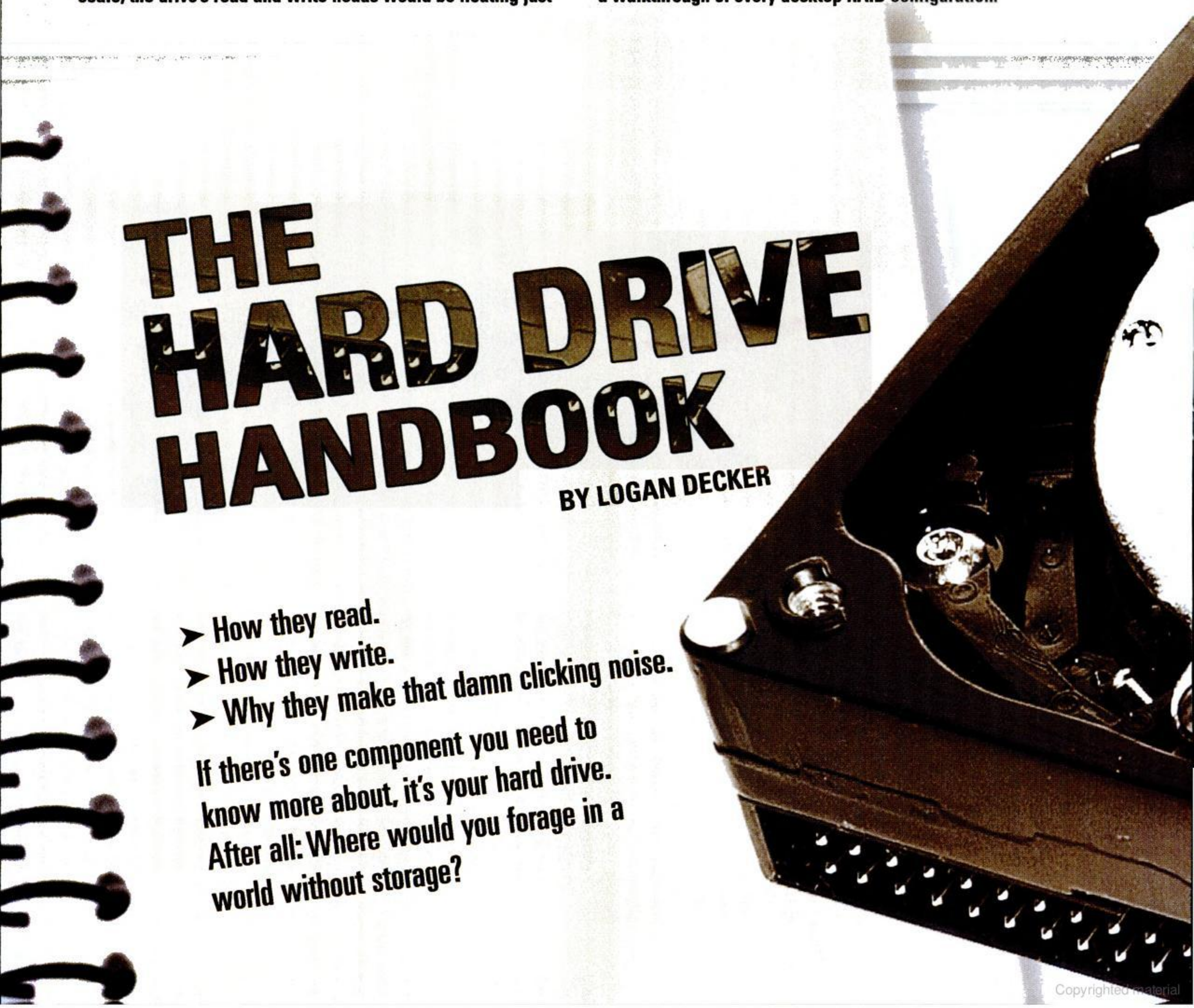
There's a lot to be grumpy about when a hard drive doesn't deliver data, and it's true that the mechanical arms of a drive's read and write heads can't even approach the throughput speed of your CPU, videocard, and system memory. But if you look closely, you'll find that your hard drive does a few things with such incredible precision, at a scale so infinitesimal, even the technology behind the fastest processors appears pedestrian. Not convinced? In his book *Upgrading and Repairing PCs* (www.quepublishing.com), Scott Mueller offers a vivid illustration of the nearly incomprehensible physical tolerances that are engineered into drives:

Let's say we enlarge a drive head slider assembly (which is typically about 0.049 inches long) to a size roughly equal to the Sears Tower. If we then enlarge the rest of the hard drive to this scale, the drive's read and write heads would be floating just five millimeters above the surface of the drive platters!

Imagine: A skyscraper-size drive head floating five millimeters above a surface rotating at (again, to scale) almost 18 million miles an hour! This is the physical wonder that is your hard drive, and if that doesn't impress you, check your pulse. But Mueller's comparison isn't just for oohs and aahs. Imagine if the skyscraper hits the platter surface—maybe some gigantic alien picks up the drive at the wrong time. This could easily lead to data Armageddon.

It's all very fascinating, and knowledge is power. The more you know about how hard drives work, the better off you'll be when making upgrading decisions, installing drives in cases, and running hard drive utilities.

In this month's Hard Drive Handbook, we take you inside the shell of a typical power user's hard drive, showing you how 50-year-old technology converges with cutting-edge thermodynamics. We also go directly to the manufacturers for answers to burning questions about areal density and other mysterious storage voodoo. And for extra credit, we take you on a walkthrough of every desktop RAID configuration.



THE HARD DRIVE HANDBOOK

BY LOGAN DECKER

- How they read.
- How they write.
- Why they make that damn clicking noise.

If there's one component you need to know more about, it's your hard drive. After all: Where would you forage in a world without storage?

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Here we look under the hood of Western Digital's 100GB WD1000 Caviar drive.

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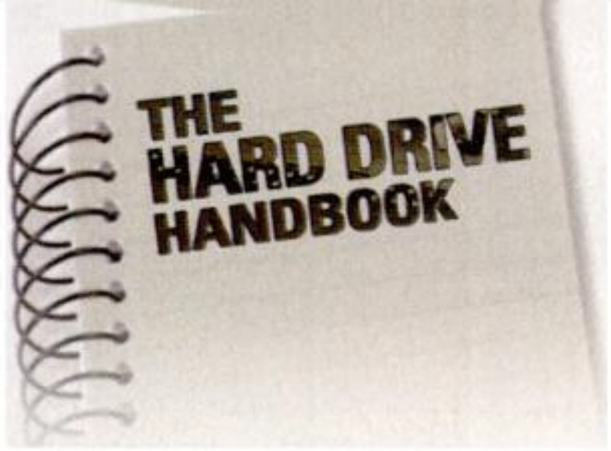
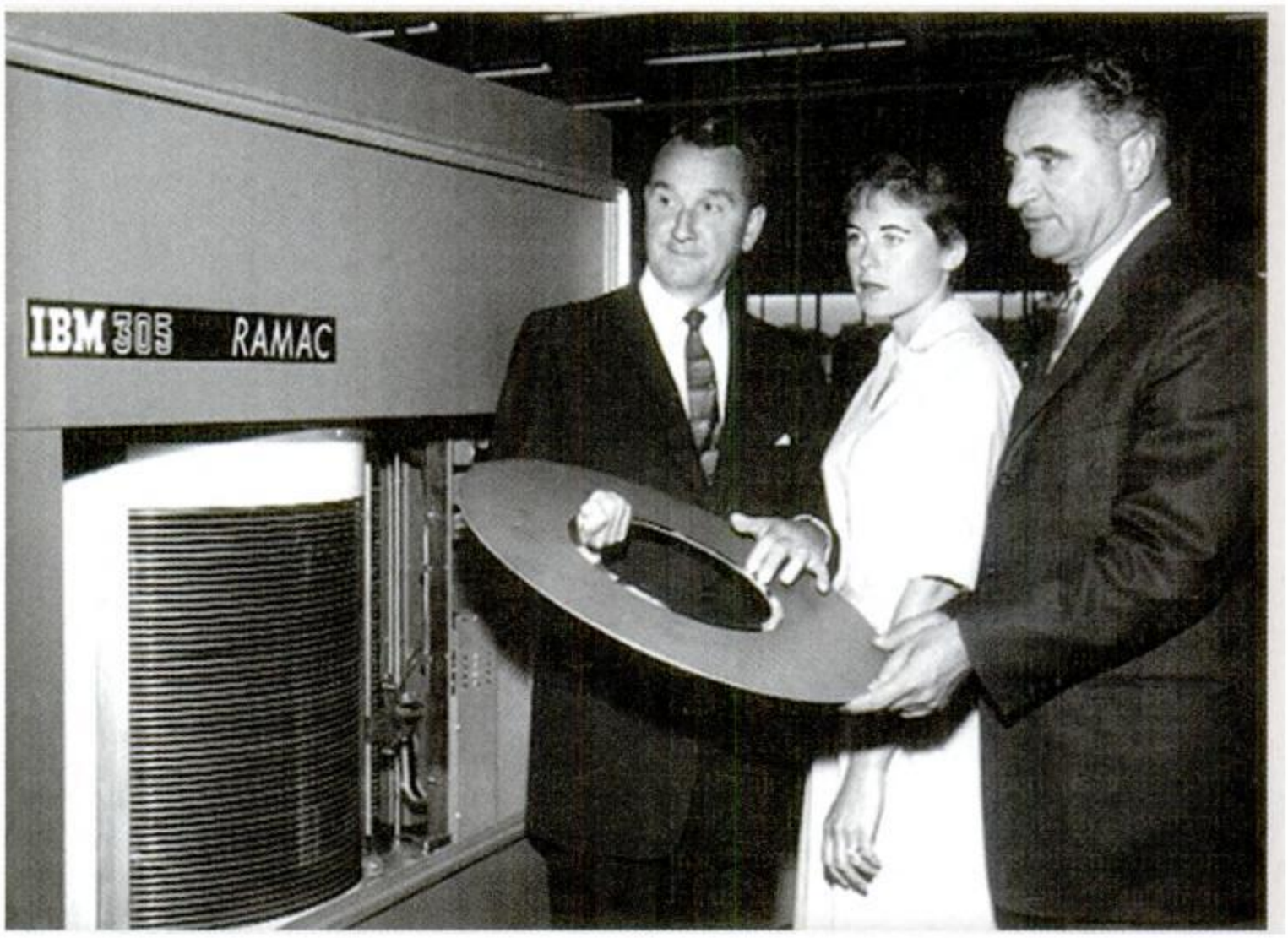


How Hard Drives Work

How much do you really know about your disks of brawn?



"Are you sure we can't fit in one more?" Jeff, Betty, and Ken check out the first IBM hard drive, boasting 50 platters, each 24 inches across.

Your PC's hard drive is really an amalgamation of crusty-old technologies taken to their extremes. The first devices to use oxide-based magnetic media were made in the 1930s. Going back even farther, in 1876 Alexander Graham Bell drew a schematic for a voice coil that would move speaker cones. And folks were having fun with electromagnetism—the principle that enables magnetic recording—decades before that.

Over the years, all these innovations have been reiterated, refined, tweaked, and pushed to their limits during the course of hard drive research and development. In the 1950s, engineers built a giant array of 50 24-inch disks that collectively held less than 5MB. Today, we have myriad hard drive-based storage devices that can be as small as one inch in size and sturdy enough to casually toss in a shirt pocket. That one can actually jog with a mini hard drive strapped to an arm is an engineering miracle in itself. You'll understand why as you read the next few pages.

GETTING A HEAD OF THE GAME

A hard drive has several platters stacked on top of each other, and each platter is coated with magnetic particles. These particles store your data—they're arranged in a particular order by your drive's write head, and then the data described by this arrangement is picked up by your drive's read head (we'll describe this process in greater depth later in the article).

The heads that read and write to the platter are positioned at the tip of a read/write arm assembly, which looks something like the arm of a record player. At the base of the assembly is a coil of copper wire. By running a current through this coil, a magnetic field reacts with a strong magnet installed above the coil. This magnetic field can be manipulated to drive the arm back and forth, pivoting on an actuator. The flex circuit attached to the read/write arm assembly provides the tiny bit of power necessary for the heads to function.

When your PC is powered down, the drive head assembly is actually resting on the innermost ring of your hard drive in an area called the landing zone. (If you were to look at a CD-ROM as if it were a hard drive platter, the head would be resting just outside of the clear hub in the center.) As soon as the PC turns on, the spindle motor in the center of the disk platters begins to spin up to its fixed rotational speed (up to 15,000rpm in some server drives, but usually 7200rpm in desktop drives, and 5400rpm or 4200rpm in notebooks). The spindle motor is inside the spindle itself. In older drives, the motor was surrounded by metal ball bearings that supported and stabilized the shaft, but newer drives use fluid dynamic bearings instead. These bearings use a thick oil instead of metal balls, resulting in drives that are whisper-quiet even at high rotational speeds.

As the platter spins up, the drive head assembly skids on the platter spinning beneath it. A thin layer of lubricant protects the platter from developing a groove underneath the drive head. After initial spin-up, something happens that would make peoples of primitive cultures drop to their knees in awe: The drive head lifts off the surface of the disc, and hovers above it.

This is particularly surprising, considering that all drive heads are tensioned with springs to keep them flat against the landing zone when the drive isn't being used (this to prevent damage when the drive is moved, handled, or used in a game of hot potato). The heads actually float above the disc against the pressure of the springs. The big secret is that grooves are cut into the "slider," which is the tiny apparatus at the tip of the drive head arm. As the disk spins faster and air currents form, these grooves create an air cushion that lifts the drive heads up and suspends them over the media.

In fact, every single nanometer of the interior of a modern hard drive has been designed with paramount respect for airflow. Every design detail is deliberate, from the cutaway at the top of a drive that channels air through a filter (designed to catch any particles that might fly off the surface of the drive over time), to the peek-a-boo holes in the drive arms that help keep the assembly aloft.

A common misconception about hard drives is that they are hermetically sealed. In actuality, all drives used in consumer PCs have a small hole on the top, usually next to a sticker in all caps that says, "DON'T EVEN *THINK* ABOUT COVERING UP THIS HOLE." The hole is there in order to allow the drive to compensate for changes in air pressure. It is, of course, protected with extremely fine filters; even the smallest particles get

continued on page 50

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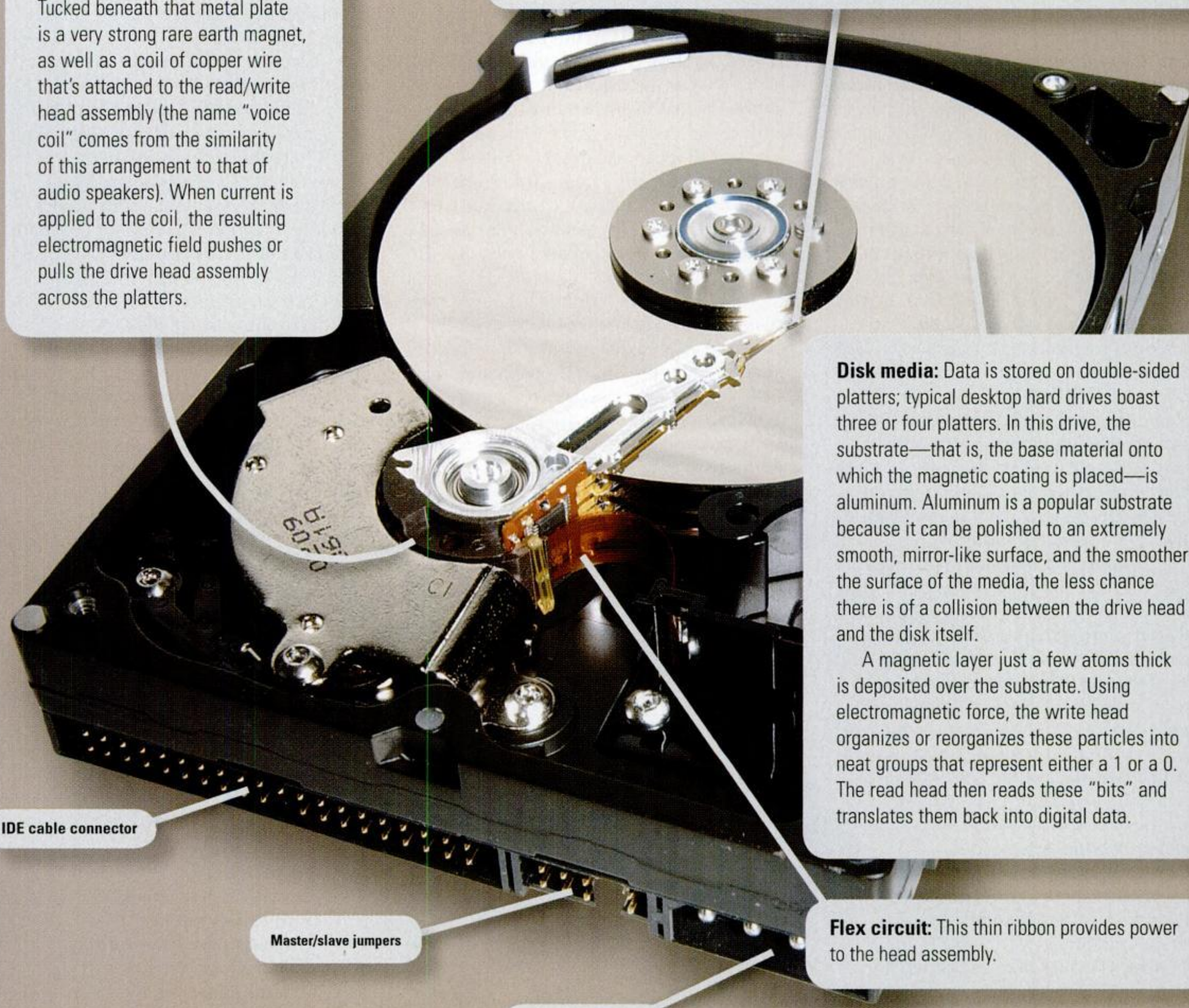
Anatomy of a Hard Drive

One hard drive courageously gave its life to provide you with this glimpse into the inner workings of magnetic storage. Use discretion. This isn't for the squeamish.

Magnet and voice coil: These particularly cool-sounding components control the positioning of the drive heads. Have you ever pretended to be telekinetic by pushing around one magnet using the repulsive force of another? That's how the system works. Tucked beneath that metal plate is a very strong rare earth magnet, as well as a coil of copper wire that's attached to the read/write head assembly (the name "voice coil" comes from the similarity of this arrangement to that of audio speakers). When current is applied to the coil, the resulting electromagnetic field pushes or pulls the drive head assembly across the platters.

Read/write head assembly: Like the old cassette recorders of yore, there are two separate heads for reading and writing data in a drive head assembly. We're pointing out the "assembly" here because the actual read/write heads are so small, they could be hidden behind the leg of a gnat.

Most modern hard drives employ GMR heads. GMR, oddly enough, is an acronym for "giant magnetoresistive." This term isn't intended to sound ironic; the name comes from the "giant magnetoresistive effect," a sly technique discovered in the 1980s that allows weaker magnetic fields from the disk media to be picked up by the read/write heads, resulting in more data packed into less space.



Disk media: Data is stored on double-sided platters; typical desktop hard drives boast three or four platters. In this drive, the substrate—that is, the base material onto which the magnetic coating is placed—is aluminum. Aluminum is a popular substrate because it can be polished to an extremely smooth, mirror-like surface, and the smoother the surface of the media, the less chance there is of a collision between the drive head and the disk itself.

A magnetic layer just a few atoms thick is deposited over the substrate. Using electromagnetic force, the write head organizes or reorganizes these particles into neat groups that represent either a 1 or a 0. The read head then reads these "bits" and translates them back into digital data.

Flex circuit: This thin ribbon provides power to the head assembly.

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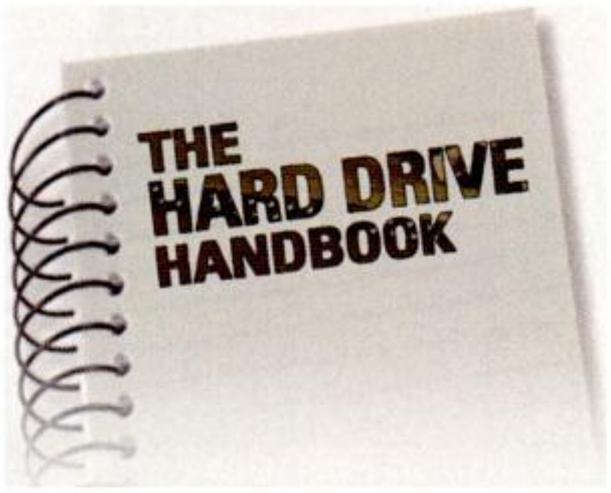

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carded at the door.

Please don't ever cover up your drive hole.

DO THE WRITE THING

Now the drive is powered up and the OS is taking orders. Let's say you just created a *Word* document. If you live here in the San Francisco Bay Area, that file is probably called "resume." Let's watch the hard drive save it.

Before it left the shop, the hard drive was low-level formatted, meaning that sectors of equal size were created along circular tracks throughout the disk and then filled with a "test pattern" of dummy information. (Naturally, there are more sectors at the larger, outer portions of the drive, so this is where performance tends to be fastest.) Low-level formatting is akin to dividing real estate into individual plots for later construction. This "later construction" comes in the form of high-level formatting, which, to follow the analogy, is tantamount to grouping lots by subdivision, assigning addresses to each plot, and publishing the address of all the residents. You can easily wipe a drive clean by doing a high-level format from the command line or within Windows—people do it inadvertently all the time. But there's no reason to do a low-level format on your own.

Powered by a flex circuit attached to the base of the arm, the first thing your drive does is find some empty space for your document. Once some unoccupied sectors have been found, the write head goes to work. The head creates a very small magnetic field in brief pulses (if you could see it, the pulses would look like a tiny balloon bulging out of the drive head and gently grazing the disk before deflating). The pulses can have one of two polarities (positive or negative). Thus, each spot that gets written to—called a bit cell—becomes, essentially, a tiny magnet with its own polarity.

Now, it would be nice if the polarity of a bit cell simply represented a 1 or a 0, but in the quest for ever-increasing areal densities—the amount of information that can be packed into a single platter—manufacturers use complex encoding schemes that derive values from the patterns of changing polarities in order to pack more information into smaller spaces. Writing our *Word* file to contiguous blocks is preferable for obvious reasons, but if the write head runs into other data, it will merrily skip to the next empty block and continue writing. Once the writing process is finished, the addresses of all the places where the goods have been stashed is recorded to the drive's table of contents, and the read/write assembly heads over to the office water cooler to wait for another job.

THE READER'S DIGEST

OK, so you didn't get the job; maybe your resume needs a little touch-up. When you open your *Word* document, your hard drive looks up the address (or addresses) of your resume in its table of contents.

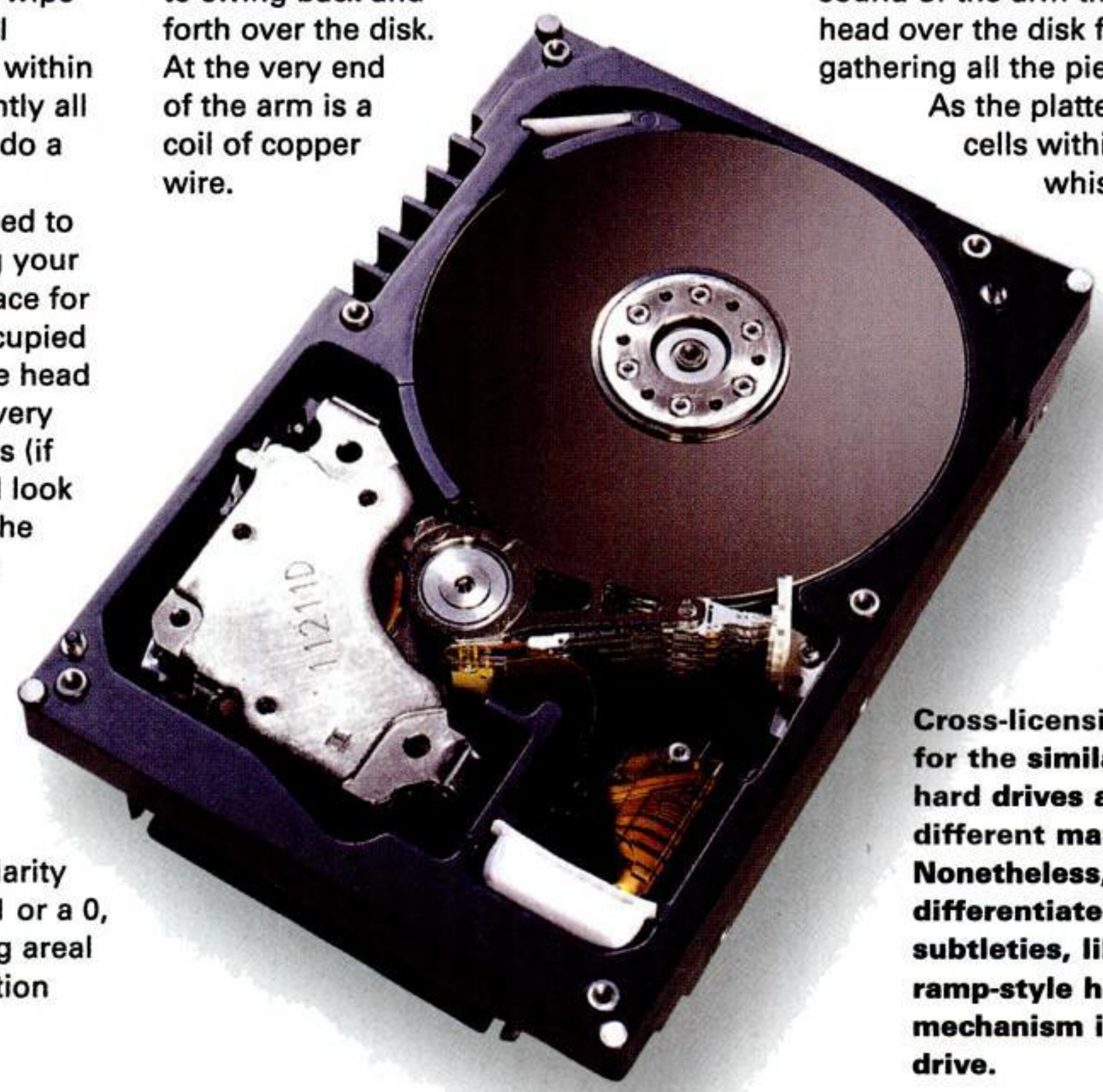
But those pieces might be scattered across different places on several platters, which makes the file retrieval process all the more difficult. So how did the hard drive inventors make a motion actuator that can accurately position and reposition drive heads hundreds of times a second above tracks that are microscopic? It's like asking a skeet shooter to hit 200 skeet every second—from orbit.

They did it with magnets. The arm that suspends the read/write heads over the platters has an axis (called an actuator) near its rump on which it pivots side to side, allowing the heads to swing back and forth over the disk. At the very end of the arm is a coil of copper wire. Suspended above (and sometimes above and below) the coil is a very strong rare earth magnet. By running a current through the copper wire, an attractive or repulsive force is created by the magnet, and the force swiftly pushes or pulls the read/write arm in the correct direction. There's no friction from a motor to slow it down or wear over time.

So, back to our resume quest. The read head checks out the disk's table of contents and figures out where all the pieces are. And now the real journey begins. The read head sweeps over the disk surface in order to locate the correct track, the specific ring on the disk that contains the data the drive head is looking for. Once it finds the track it's looking for, it has to find the correct sectors (the addresses of the individual plots from our earlier analogy).

How the correct sectors are located is a surprisingly hit-and-miss affair—it goes something like this. Think of an address on the block where you live. Drive your car to one end of the block. Close your eyes. Start driving down to the other end of the block. Stop when you think you've arrived at the address. Open your eyes. Check the address. Whoops, you're not there yet. Close your eyes. Move forward again. Open your eyes. Check the address. Whoops, overshot the mark. Drive around the block and back to your starting point. And so on, until you've positioned yourself correctly. It seems inefficient, but with the disk rotating at 7200rpm, it doesn't take long to find the correct sector. The clicking you hear when a hard drive whips into action is the sound of the arm that suspends the read head over the disk flicking back and forth, gathering all the pieces of data it needs.

As the platter rotates, the bit cells within each sector are whisked beneath the GMR element, which is the business end of the drive head. But the magnetic



Cross-licensing accounts for the similarities of hard drives among different manufacturers. Nonetheless, they're differentiated by subtleties, like the ramp-style head parking mechanism in this Hitachi drive.

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encoding of the data on the surface is extremely weak. Because contemporary drives pack so many bit cells in such a small area, if the signals were made stronger, they'd interfere with each other. That's why hard drive heads have to fly so close to the disk surface. If they were further away, the magnetism would be impossible to detect.

But even flying as close to the surface as they do, there are bound to be minute variations in the strength of each polarized bit cell, making the cell difficult to read. Think of it this way: Look at a mountain range from afar, and draw an imaginary line between the shortest and tallest peaks. Every peak above the line represents a 1. Every peak below it represents a 0. But, naturally, some peaks will be closer to the line than others. Those peaks near your imaginary line are going to be difficult to resolve.

You've probably caught on that the read head can't always be 100 percent certain about the polarity of each bit cell. It actually uses a probability algorithm to help it ascertain the correct values. For example, most of the bit cells in one group might be negative, but one or two read ambiguously. The algorithm steps in to say, yeah, it's probably a negative value. As the drive head reads all the bit cells from all the appropriate sectors, the data is reconstructed using the RLL decoding scheme.

"YOUR HARD DRIVE'S READ HEAD CAN'T ALWAYS BE 100 PERCENT CERTAIN ABOUT THE POLARITY OF EACH BIT CELL. IT ACTUALLY USES A PROBABILITY ALGORITHM TO HELP IT ASCERTAIN THE CORRECT VALUES."

When you've finished printing out your resume and power down your PC, the actuator pushes the head assembly back to the landing zone at the innermost cylinder of the disk. The lubricant cushions the landing, and the disk comes to a stop.

But here's a real kicker: If the power to your PC is suddenly cut off, or if you simply press the power button while the drive is still working, the spindle motor will still rotate due to momentum. The minute power drops out, what was once a power-eating motor becomes a power *generator*. The tiny bit of juice squeezed out of the fading motor is just enough to safely move the read/write head assembly to the landing zone where the heads can be parked.

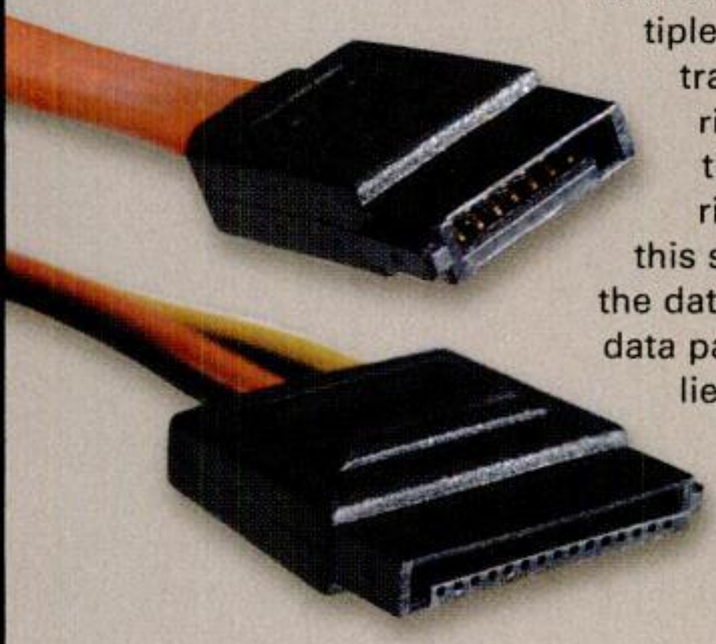
Electronics are, by nature, capable of incredible speed and efficiency. But despite the limitations of some old-fashioned mechanics, it's the hard drive that truly dazzles us with its cleverness of design. To hear it described, you'd imagine a hard drive would be so delicate that even harsh language might cause it harm. Yet hard drives survive daily jolts, drops, and other obnoxious behaviors all the time. Even when a sudden jolt causes the drive head to collide with the disk and ruin a few sectors, the hard drive simply flags the bad areas with a couple traffic cones and moves on.

Your Guide to Serial ATA

Why the PC industry is rushing away from parallel ATA

Take a look at a machine equipped with Serial ATA, and the most striking feature will be the skinny data cables. While skinny cables have a positive impact on a case's internal airflow, this isn't the main reason why the PC industry is dropping parallel ATA (and its flat, wide cables) for SATA. The main reason is that the current parallel interface is facing a performance wall.

Parallel ATA cables send data along multiple wires. Each piece of data must travel along the length of the familiar ribbon cable, and arrive at the same time in order to maintain data integrity. In order to get more speed from this scheme, the only option is to push the data to higher frequencies or make the data path wider. That's where the problems lie. Making the data path wider is impractical, as there are already 80 conductors in the ribbon. And increasing speed adds to the likelihood of data corruption.



Serial ATA drives have separate cables for power (above) and for data (below).

Because serial interfaces don't have to deal with coordinating multiple lanes of data, we're able to push them to much higher speeds. SATA is currently rated for 150MB/s, slightly higher than the 133MB/s offered by the fastest parallel ATA spec (which still hasn't been widely adopted). SATA will eventually double to 300MB/s in 2004, and then again to 600MB/s by 2007.

The first SATA implementations on motherboards were kludgey: Serial ATA chips were piped through the PCI bus. This limited the 150MB/s potential of SATA to PCI's 133MB/s throughput, and required the loading of drivers just to recognize the chip. But current generation SATA-equipped motherboards should be plug-and-play. In Intel's new ICH5 southbridge chip, for example, SATA is native. Plug a SATA hard drive into an 875P motherboard, and you can load WinXP without needing to install any drivers.

Because of their bandwidth needs, hard drives were the first SATA candidates, but next year we'll likely see the first optical drives with SATA interfaces. Because of the glut of parallel devices, it'll probably take two to three years for the whole PC industry to drop parallel ATA entirely.

Although current hard drive data rates fall far short of the maximum throughput of even parallel ATA specs, companies are laying the foundation for the future. You don't, after all, wait for the traffic jam before you try to build the roads (unless you run the state of California).

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THE HARD DRIVE HANDBOOK

RAID Aid

A handy reference guide to striping and mirroring

In 1987, researchers at UC Berkeley coined the term "redundant array of inexpensive disks," or RAID for short. Inexpensive? Don't ask. Today it's known as "redundant array of independent disks," and it's ballooned into five major variants.

If one hard drive is good, then two hard drives working together must be better, right? That's the idea behind RAID, which lumps together multiple drives to increase performance, provide additional protection for your data, or both. "Striping" boosts performance by reading and writing to multiple drives simultaneously (like writing with both your left and right hands at the same time). "Mirroring" is an insurance policy that writes every bit of data to a redundant drive. These methods can be combined in a number of ways, called "levels." The following is a table comparing the most popular RAID levels.

—DWIGHT LOOI

RAID Levels Compared

RAID level	AKA	Minimum drives required	Advantages	Disadvantages	Typical applications
0	**Striped array.** Data is stored across multiple drives.	2	Very high read and write performance—almost that of a single drive multiplied by the number of drives used.	Technically not a RAID but an "AID" because it has no redundancy. The failure of any drive compromises the entire array.	Environments where raw speed is valued over data integrity. Video editing stations, high-end game servers, etc.
1	**Mirrored array.** Data is duplicated on separate drives	2	Better read performance than a single drive. Full redundancy protects data from the failure of any one drive in the array.	Capacity is half the total storage available on member drives. Write performance is marginally worse than a single drive.	Environments where data integrity is favored over raw speed. Web servers, database servers, etc.
5	**Striped array with distributed parity.** Data and parity information are stored across multiple drives.	3	Superior performance compared with RAID 1. Better storage efficiency compared with RAID 1. Parity information provides data protection though error checking and correction.	Not as fast a RAID 0. Parity calculations and storage reduces array performance and capacity, respectively. Requires expensive controller card and more drives to implement.	Environments where data integrity is paramount, but speed is also highly desirable, such as enterprise servers.
0+1	**Mirrored array of striped sets of drives.** Data is stored and duplicated across multiple drives.	4	RAID 0 performance with RAID 1 redundancy. Superior performance to RAID 5 with data security.	Requires a minimum of four drives and expensive controller card. Not as robust as RAID 1+0.	Environments that require exceptional performance as well as data integrity.
1+0	**Striped array of mirrored pairs of drives.** Data is stored and duplicated across multiple drives.	4	RAID 0 performance with RAID 1 redundancy. Superior performance to RAID 5 with data security.	Requires a minimum of four drives and expensive controller card. More robust than RAID 0+1.	Environments that require exceptional performance as well as data integrity.

Where Have All the Levels Gone?

What happened to all the other RAID levels? Well, RAID 2 is a striped array with error correction based on Hamming code. It never got off the ground because it required a huge number of drives and offered average performance. RAID 3 and 4 are both stripped arrays with parity information stored on a separate drive. Because such dedicated parity storage is both an extra complexity and potential performance bottleneck, RAID 5 is usually a better choice. RAID 6 is an extension of RAID 5 in which double parity is stored for an extra level of protection. RAID 6 performance is inferior to RAID 5, which made it unpopular. RAID 7 is a proprietary standard from Storage Computer Corp. It uses cached striping with dedicated parity.

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The Top 5 RAID Tips from Promise

Advice on configuration from the RAID experts

Promise pioneered the use of low-cost ATA drives in RAID arrays, enabling high-end performance at one-half to one-third the cost of SCSI drives. If you're already using ATA RAID, then you know it's a cost-effective solution for kicking up storage system performance. And, if you're into maximum performance, you're probably using RAID 0. Storage system performance is directly related to the hardware you use, but there are still some good rules that apply to all hard drives. Here are some tips from Promise (**www.promise.com**) that should ensure you're getting the most out of your RAID 0 storage.

1 When using ATA drives, configure the drives as Master drives, with one drive per channel. Using Slave drives will increase overhead, reducing performance.

2 Use the RAID 0 array as a data drive and not as the boot drive. When the operating system and the page file reside on the boot drive, it creates overhead that can diminish the performance of applications like Adobe's *Photoshop* and *Premiere*.

3 Using the page file on RAID 0: If you are using multiple RAID 0 arrays—either four drives in Master/Slave (ATA) or four drives as Master on a SATA RAID controller, we recommend the following:

- ➤ Boot to onboard IDE
- ➤ Use array 1 for page file (experienced users only)
- ➤ Use array 2 for the data drive, applications, games, and more

4 When using Windows XP, turn off the System Restore on the RAID 0 array. System Restore monitors the disk (array), reducing performance.

5 Use single partitions. Using multiple partitions reduces application performance because you are running I/O to more than one partition on the same disk (array). If you use multiple partitions, do not move the page file to any of the "partitions" on the array where your applications or games are running—this will prevent you from getting optimal performance.

THE HARD DRIVE HANDBOOK

Answered: Your 10 Most Burning Hard Drive Questions

We ask the "Big Three" hard drive companies to share all they know about future technologies, performance tweaking, cable rounding, and more

Are IDE hard drives likely to ever spin faster than 10,000rpm?

Seagate: Given the history of advances in storage, one almost has to assume that would happen eventually. At the moment, though, hard drive performance has advanced to the point that it's no longer the bottleneck it used to be... We'll have to wait and see what kind of new applications develop over the next several years, and whether they drive demand for that kind of performance shift.

Western Digital: This is unlikely in the short term. The additional cost and reduced capacity associated with producing drives at higher than 10,000rpm is unlikely to be accepted by the system manufacturers or users.

What do you think will be the next performance-boosting trend, and when can we expect it?

Seagate: I think we're experiencing it now, with the introduction of Serial ATA and Serial Attached SCSI interfaces. I'm not referring only to their faster external transfer speeds, though those were a critical reason we had to introduce serial interfaces. Although SATA is in its infancy, already we can see performance improvements escalating as the various component makers work out the best ways to use the full potential of SATA's more efficient data handling.

Does increasing areal density really improve performance?

Western Digital: Increases in areal density usually result in performance increases. There are two components to areal density: track density (how many concentric tracks we lay out on a disk surface), and linear bit density (how many data bits are laid out along each track). If the recording density is doubled, say from 40GB to 80GB per platter, then you could expect approximately 40 percent increase in the raw data rate (square root of 2 minus 1). This assumes that track and linear density are both increased at the same rate.

Hitachi: Absolutely, higher areal density allows more bits to be packed into smaller areas, which benefits both linear (sequential) and radial (random) throughput and access.

If I drop a hard drive and it still works, should I replace it anyway?

Seagate: If you drop a drive that is not in operation, you should run a diagnostic utility, such as Seagate's *SeaTools*. If the diagnostic says the drive is OK, you can safely keep and use the drive. Experiencing shock during operation is much more dangerous—a head slapping against a disc can leave loose debris inside the drive that may cause problems later. Best to at least back up that drive, and set it aside for a few weeks of testing to ensure no latent errors turn up.

Western Digital: First step: Back it up (but you do that regularly anyway, don't you?). On second thought, the first step should be don't drop it! You might hear increased noise from the drive, which may indicate that the bearing was damaged. You might see increased block reallocation over time. It comes down to how much you love your data. Hey, it's always a good excuse to go looking for upgrades. Remember, when the going gets tough, the clumsy go shopping.

Who needs SCSI these days?

Seagate: Many applications today require SCSI's advanced protocols, its

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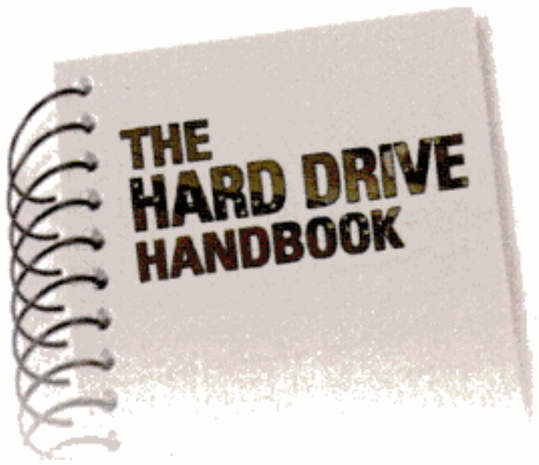

Answered: Your 10 Most Burning Hard Drive Questions

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more advanced data protection features, its flexible performance tuning and variable sector sizes, richer command queuing, command reordering, and multi-host access.

Hitachi: SCSI was designed for multiuser, multitasking applications and large storage and mission critical data applications where the most rigorous and performance features are required. SCSI will continue to be an important interface for use in RAID and other enterprise environments.

Western Digital: Nobody really—high performance and high reliability are both available with Serial ATA. Of course if you are feeling charitable and wish to give money away, then feel free to buy SCSI components.

What's the number one thing I can do to increase performance of my drive?

Seagate: Defrag it, and ensure that all your controller cards have the latest drivers. Frankly, there is no user-serviceable speed throttle on an ATA hard drive. The drives are already designed to boot and use the fastest mode supported by the system hardware to which they're attached. SCSI drives actually have a unique flexibility in this regard. They can be optimized for different kinds of performance in different environments, using a SCSI mode-page editing tool made by a third-party vendor such as Tabernus. One inherent value of SCSI is that it can be modified to the technical requirements of a developer. But, most end-users don't have the technical expertise or the need to make these kinds of adjustments.

What's the number one thing I can do to increase the longevity of my drive?

Western Digital: Treat it nicely. Don't drop it, keep it away from extremes of hot and cold, run the system cool, and make sure that the drive vents aren't blocked. Don't press on the cover, and wear an ESD strap when you're handling the drive.

Hitachi: Drive longevity can be maximized by ensuring that the system is adequately cooled. Also, the drive should be properly mounted to protect against excessive shocks and vibration.

Seagate: Never move a desktop PC when it's turned on. Today's modern drives are very robust. For example, they automatically reallocate data from bad sectors to good sectors on the fly during use. Any time a drive hits a sector that's marginally hard to read, it will move the data to a spare sector on the same track, which then becomes the primary sector of use for the rest of the drive's life. In other words, the drives are starting to take care of themselves, making them less likely to fail.

What are the most common symptoms of impending drive failure?

Seagate: One possible sign might be the failure of a file that's critical to loading a program. If you see a recurring problem within an application whenever it loads or executes a particular function, that may be your hint that it's time to run a hard drive diagnostic program like Seagate SeaTools. Metallic or grinding noises mean you should immediately adopt a backup plan, back up your critical files, and investigate the drive.

Hitachi: Human-perceived characteristics are not predictors of impending drive failure. Pre-failure drive symptoms are very difficult to pinpoint and dependent upon the system and software being used. For Hitachi drives, we provide an early warning feature called Self-Monitoring Analysis and Reporting Technology (SMART), which supplies information to the system to aid in identifying device degradation and/or faults. To be safe, it's best to run SMART periodically to check the health of the drive; end users cannot easily detect impending drive failure and should not depend on their own senses to detect pre-failure symptoms.

Do rounded parallel ATA cables affect drive performance?

Seagate: Yes. Rounded cables are not defined in the official industry specification for ATA cables, and they can potentially increase data crosstalk between wires in the cable, which might require the drive to resend data, thus slowing response time.

Western Digital: The 80-conductor parallel ATA ribbon cables are designed so that there is a ground line between every signal line. This cable was first introduced to enable the higher speeds of Ultra ATA/66—the extra ground lines reduce the effect of cross-talk on adjacent data lines. Bunching the signal lines back together means that performance could be adversely affected by round cables.

What's the difference between a server drive and a desktop drive?

Hitachi: There are inherent design differences, which are based upon the primary applications they serve. Desktop designs are motivated primarily by cost considerations. Designs for server drives primarily focus on reliability and performance for the mission critical-based applications. Thus, they rely on advanced mechanical designs and sophisticated firmware.

IDE drives were initially designed for single-user desktop applications, while SCSI drives were intended for use with workstations and servers. Desktop drives require fewer electronics to move data to and from the disks for a single user, and the computer's controller is less complex. IDE's simplicity enables a lower cost storage solution.

Western Digital: The most significant difference is in rotational speed. Server drives are typically 10,000rpm or faster. They are designed for heavier duty cycles, 100 percent at 24x7 operation—and because of these higher design specifications, these drives boast higher reliability ratings and typically carry a five-year warranty. Before the introduction of the WD Raptor, the only choice was SCSI or Fibre Channel. Now system manufacturers have a lower cost alternative in SATA without giving up performance or reliability. ■

> *"ANY TIME A DRIVE HITS A SECTOR THAT'S MARGINALLY HARD TO READ, IT WILL MOVE THE DATA TO A SPARE SECTOR ON THE SAME TRACK... IN OTHER WORDS, DRIVE'S ARE STARTING TO TAKE CARE OF THEMSELVES."*

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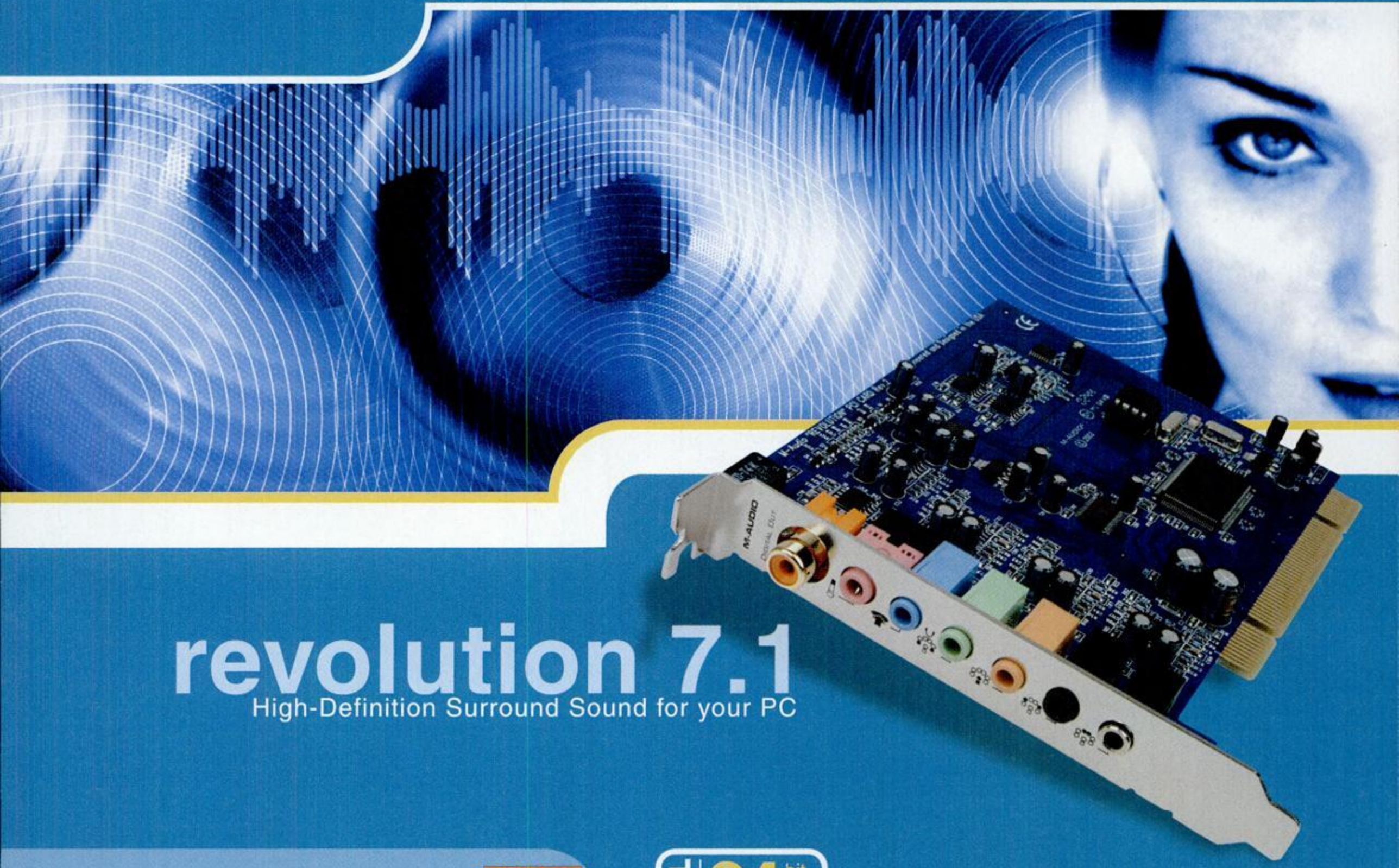

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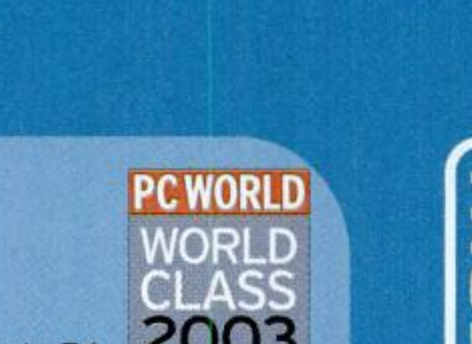

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EXPANSION

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Ask the Doctor

Symptom ▶ Diagnosis ▶ Cure

DIRECTX 9 AND OLDER CARDS

My son and I like to play *Quake2* using OpenGL. My son likes to play head-to-head with me, but his computer won't play *Quake2* in hardware mode. It works with the software renderer just fine. Our systems have a very similar configuration: an AMD XP 2200+, 512MB DDR, Radeon 9000, and Windows 2000 Pro. I've done the software updates and patches for Win2000 and *Quake2* itself.

—STEVE BURKE

Most likely you forgot to update his videocard driver. Both of your videocards—really any videocard that can be purchased today—should play *Quake2* with hardware acceleration enabled.

The drivers that ship with Windows may run many DirectX games, but they won't accelerate a single OpenGL game. Microsoft doesn't ship OpenGL drivers with Windows.

If you've updated his driver, and the game still won't run, check the *Quake2* directory for a file named opengl32.dll. This file is an OpenGL driver for old 3dfx cards, and isn't necessary for your ATI card. In fact, the presence of that file can confuse the game, making it not work. Simply renaming the file can render it harmless.

MY BROWSER THINKS EVERY SITE IS NAUGHTY!

My son turned on the Internet Content Advisor in *Internet Explorer*, and set a password that he doesn't remember. Now I can't go to any web sites at all, everything is "content protected." Can I turn this off, or do I need to reinstall Windows?

—SHERI SMITH

Lucky for you, Sheri, there's an easier way to disable the Content Advisor than reinstalling Windows, but you'll need to edit your Registry. First, close *Internet Explorer*, then click the Start Menu, then go to Run. Type Regedit in the space provided, and press Enter. Then browse down to HKEY_LOCAL_MACHINE/Software/Microsoft/Windows/CurrentVersion/Policies/Ratings. Click the Key icon and press Delete. Close Regedit and restart *IE*. Go to the Tools menu, then click Internet Options and go to the Content tab. Click the Disable button, and you'll be prompted to enter a new password before you can turn off the Content Advisor. Enter a new password—so this won't happen again—and the Content Advisor will be disabled.

If you inadvertently lock yourself out of every site on the web using the Internet Content Advisor, you can reset the password with an easy Registry edit.

FYI: *Internet Explorer's* Content Advisor denies a user access to any sites that don't bear a self-imposed content rating. The fact is, few web developers bother with these ratings, making *IE's* optional feature virtually useless.

> ***"NOW I CAN'T GO TO ANY WEB SITES AT ALL, EVERYTHING IS "CONTENT PROTECTED."***

SOMETIMES SLOWER IS FASTER

I have an Asus A7N8X v1.04 motherboard with the nForce2 chipset. The board supports DDR400, DDR333, and slower memory. I'm currently using DDR333 memory with an Athlon 2400+ XP processor. I'd like to know whether DDR400 memory will buy me any additional speed, or should I stick with DDR333? The main reason I'm asking is that I need to increase my memory from 512MB to 1GB in order to play *Planetside* (a co-worker told me that his lag went away when he increased his memory from 512MB to 1GB).

—ALEX BUTTERY

Your buddy's right. *Planetside* needs huge amounts of RAM. (We've even run a couple systems with more than 1GB.) More memory helps keep the frame rates up in those massive 300 person battles.

We haven't tried nForce2 boards with older Model 8 Athlon XPs running on the 266MHz frontside bus, but in our experience, nForce2 systems that run RAM at the same speed as the CPU's frontside bus yield the best performance. Since your Athlon 2400 is a 266MHz processor, the Doc recommends that you try running the RAM you have now at both DDR266 and DDR333 speeds; if there's no noticeable difference in performance, there's no reason to buy DDR400 RAM for your current system.

This is by no means a universal rule. The VIA-based motherboards we've tested don't exhibit this behavior. Running your memory faster will make your system faster with a VIA board, even if the memory is running asynchronously.

STOP THE CRACKLING SOUND!

I have a Creative Audigy 2 Platinum running on an Asus P4B533 motherboard with a 3.06GHz Pentium 4 and 1GB of RAM. After installing the new P4 chip and turning on Hyper-Threading, I now get a crackling sound when the machine first boots. Also, when playing some games my sound seems fast or out of sync with the video. When Hyper-Threading is off,

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my system works great. I'm using Windows XP Pro and have downloaded all the driver updates for the card and the motherboard. Creative tells me I should go back to the old CPU or turn off Hyper-Threading.

— CRAIG

Early drivers for the Audigy 2 had issues with Hyper-Threading and SMP systems. Generally, installing the latest drivers for your soundcard and mobo chipset, as well as flashing the motherboard's BIOS, will fix the problem. Creative recently released a set of WDM drivers that may also do the trick. If neither of these options works, try uninstalling the drivers, removing the card, and then moving the card to another PCI slot. You may also try manually assigning an interrupt or IRQ to the card in the BIOS.

If nothing seems to fix the problem, you probably need to start afresh by wiping the OS and performing a new install to correct the problem.

POWERLESS

I built my first PC a few months ago, but I'm having some problems with it now. I usually leave it running around the clock, but one day, it had stopped working. After testing a bunch of stuff, I realized that my power supply was dead, so I bought a replacement from my cousin for $14. This power supply worked for three days before I heard a pop and fizzle and my computer died again. The first power supply was a 300W, the second was 400W. What could have caused this?

—JIMBO JENKINS

The Doctor recommends that if you replace a substandard power supply, you swap it with one that costs more than $14. Like the motherboard, videocard, soundcard, and RAM, a power supply is extremely important to your PC's well-being. In addition to buying a name-brand power supply, you may want to invest in a quality power strip, power conditioner, or UPS for protection. Alternately, you could just stock up on $14 power supplies and replace them as needed.

THE BEST WAY TO SET UP AN NTFS PARTITION

I am currently running Windows 2000 Pro on an 80GB hard drive. I have another 40GB hard drive that I'd like to format with the NTFS file system, but I have no clue how to do it.

A friend told me that I'd need to make a boot disk, boot my PC with the disk, and follow the directions. All that does is get me started loading Windows, which I don't want to do since I already have Windows installed.

What should I be doing?

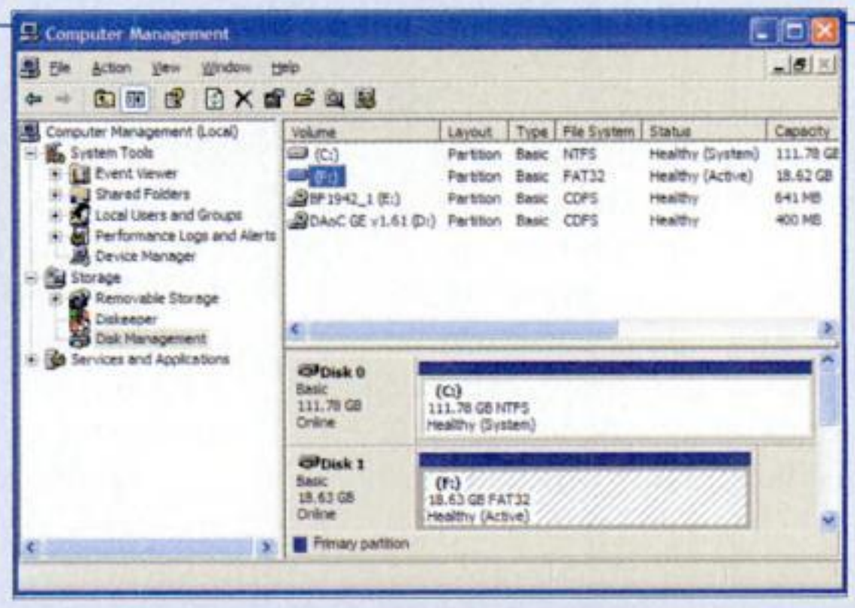
—CHRIS L

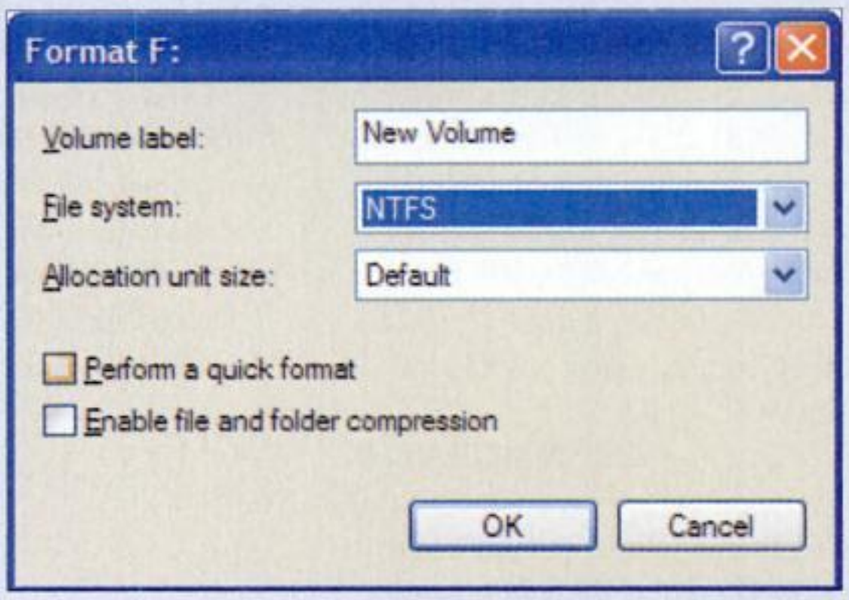
Since you just want to format a second drive, you don't need to fool around with boot disks and the like. Make sure you copy anything you want to keep to your other hard drive or another safe location. You can simply go to the Control Panel, then go to Administrative Tools, then Computer Management. Click Storage, then click Disk Management.

Right-click your second drive and select Format. Set the file system type to NTFS, leave the allocation unit size at default, and press OK. Remember, formatting completely wipes your drive, so don't try it until all your important files are saved elsewhere.

You could simply convert a FAT32 drive to NTFS by using a utility included with Windows, but we don't recommend that. Drives that have been converted to NTFS can't always be upgraded to newer versions of the file system.

The only exception is the system drive.





You don't need a boot disk to format a second hard drive using NTFS; the preferred method is to use the Computer Management tool.

Usually, it isn't worth the extra hassle to back up the C: drive, boot from the Windows CD, and completely wipe that drive, just to convert a partition from FAT32 to NTFS. You can schedule a boot-time conversion of the C: drive by typing `convert c: /fs:ntfs` at any command prompt.

WHY SO MANY KERNELS?

I have one problem that's been bugging me for a long time. I have Windows ME and a Pentium 3.1GHz system with 256MB SDRAM. When I check my system information utility and look at the programs that are running, I see four files running with the name Kernel32.dll. I'm worried that they're wasting a large amount of my memory. Are these supposed to be running? Can I delete them?

—JASHAN

Your PC shouldn't have more than one kernel32.dll loaded at a time. We set up a test system similar to the one you described, but couldn't duplicate your problem. Most likely, your multiple kernel32.dll files are the result of a recalcitrant piece of software, whether it's an app, a driver, or a virus.

Job one is to run a complete virus scan on your system. Then upgrade the drivers for your videocard, motherboard, and sound. Then check System Information (Programs > Accessories > System Tools) to see if multiple kernel32.dlls are loaded. If they are, reboot your PC and enter Safe mode. You can do this by pressing F8 when your computer begins booting. Safe mode loads only the basic drivers required to put an image on your screen, without running any of your startup apps. Run the System Information utility to see if you have multiple kernel32.dll libraries loaded in memory at this time. If only one kernel32.dll is evident, the problem is caused by either one of your startup applications or a virus.

Reboot your PC in Unsafe mode and go to Start, then Run, and type `msconfig`. Press Enter and go to the Startup tab. Uncheck everything in that window and reboot the PC. This disables all the software that starts automatically with Windows. When you restart, open System Information and check for multiple kernels. If there's only one, open msconfig again, and re-enable one or two of the apps at a time, rebooting the PC and checking System Information each time. Keep going until either all the apps are running on startup, or you've figured out which one loads the redundant kernel32.dll.

If you go through this whole process without getting rid of the extra processes, you're probably going to have to reformat your drive and reinstall Windows from scratch.

continued on page 62

Let's face it: Everything breaks eventually, including a PC. Luckily, the Doctor is here to help. Send an e-mail to doctor@maximumpc.com detailing your computer's ailment. Just remember, the Doc gets a lot of e-mail, and has time to answer only the questions that appear in the magazine!

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continued from page 61

UPGRADING OS

I have four PCs at home that I will be networking. Two of the PCs run Windows 2000 and two run Windows 98SE. I plan on overhauling, reformatting, and tweaking them before I set up a home network. I just don't know which OS I should use. I've been a loyal Win98 user for years, and I know my way around it. I'm comfortable with Win 2000, but I hear Windows XP is the way to go. Which OS will give me the best performance for what I'll be doing? If it matters, I do a little of everything with my PC, from playing games to photo editing to managing my digital music.

—BRIAN MCDONALD

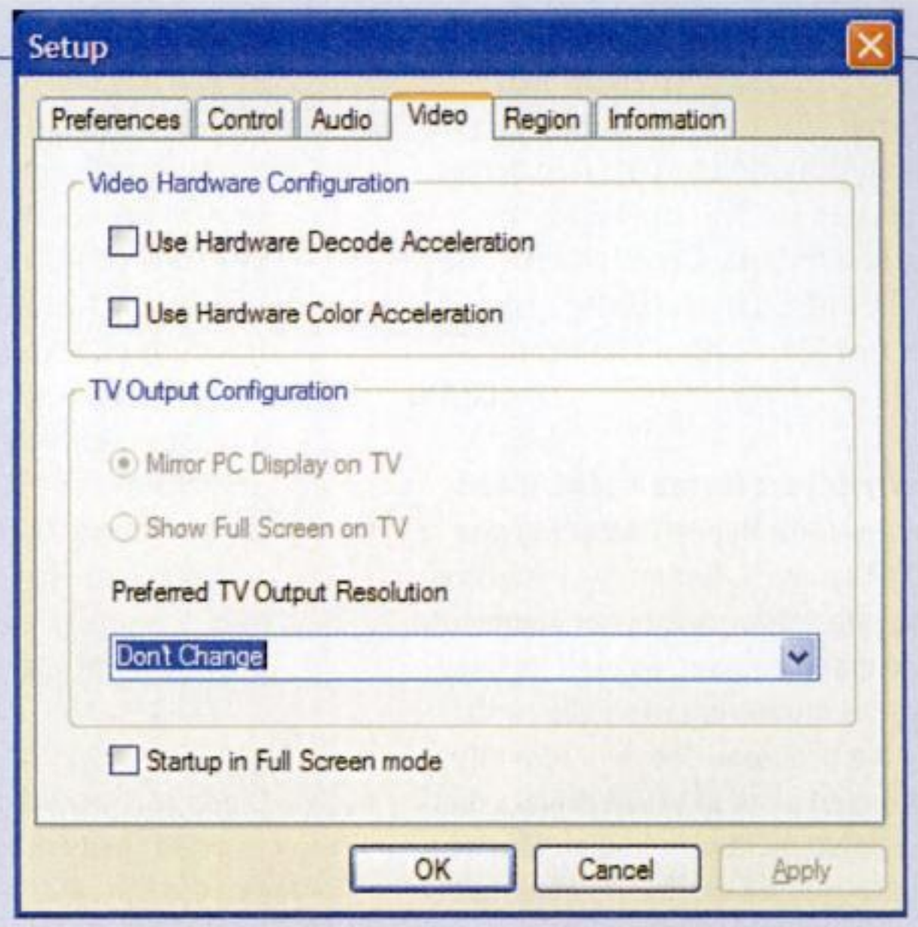
We've said it before, and we'll say it again: Windows XP is Microsoft's best OS release to date. We haven't always been such fans of Microsoft OSes (see our reviews of every previous version of Windows), but XP really improves upon all its predecessors, including Windows 98 SE. Go forth and upgrade!

SCREEN-GRABBING A DVD

I have had an annoying problem for some time now. I can't find a program that lets me take screenshots of a DVD on my computer. When I try various programs, all I get is a bitmap of a green screen. I assume this is some kind of copyright protection, but how do I get around it?

—ADAM MARSHALL

Capturing a still image from a DVD is simple if you have the right software. We use *PowerDVD* (www.cyberlink.com) to capture images, but there's a trick. In order to get an image—and not the green screen—you need to disable support for hardware decoding in the software's Options menu. *WinDVD* works much the same way.



Disabling hardware acceleration in your DVD player will let you capture screenshots of DVD movies. Just uncheck the two hardware acceleration boxes and you're good to go!

> ***"EVEN ACCOUNTING FOR VARIOUS OPERATING SYSTEM FILES AND SUCH THAT MAY NOT HAVE BEEN COUNTED, IT'S STILL 20GB OFF!"***

SUGGESTING SERIAL ATA

I'm currently building a new system with an Intel D875PBZ motherboard, and I want to use Western Digital's Raptor as my main drive and IBM's 180GXP as my storage drive. I can't find any information on how to slave an ATA drive to a Serial ATA drive. Is there anything to it? Can I just set my jumpers and go, or does Serial ATA throw the whole master/slave relationship out the window?

—NATE MILLER

Serial ATA hard drives indeed throw off the shackles of their oppressors, Nate! Serial ATA is a point-to-point protocol, and completely ditches the master/slave relationship.

For your purposes, you'd just plug the Serial ATA Raptor into one of the Serial ATA ports on your mobo, and plug the 180GXP into the parallel ATA connector. The 180GXP can be set as either the slave or the master, depending on the other devices you have plugged into that parallel chain. You'll be able to set the Raptor as your boot drive in the motherboard's BIOS, but you don't need to worry about master or slave settings for any Serial ATA devices.

NO NEED TO DEBUG

I need to find out how I can turn off *Internet Explorer's* "There's an error on this webpage, do you want to debug it?" message. It's driving me nuts. I know it all started when I installed Office XP on my system.

—JESS

This is an easy one, Jess. Open *Internet Explorer*, go to the Tools menu, then Options. Click the Advanced tab, and scroll down. Make sure that "Disable script debugging" is checked, and "Display a notification about every script error" is unchecked. That's all.

WHERE'S MY DISK SPACE?

I'm running Windows XP Pro on an 80GB Maxtor hard drive and I'm running out of space. Formatted, the drive should hold a maximum of 74.5GB. When I check the disk properties under My Computer it says I have about 3.86GB left. I know I don't have 70GB of stuff on my computer. So I enabled "Show all hidden files and folders," selected all the files and directories in my C:\ directory and went to Properties. It counted 50GB of stuff on my hard drive. Even accounting for various operating system files and such that may not have been counted, it's still 20GB off!

I tried all the standard things: I ran *Scandisk* (which showed everything was OK), checked for viruses, and checked Microsoft's Knowledge Base. I built the computer myself so there is no tech support other than the tech support from the drive manufacturer and myself. I was wondering if there was anything I could do to get my space back, other than formatting and wiping the drive clean.

—ROBERT DERVELOY

You're not the only reader that's having problems with lost disk space in Windows XP. In the last two months, we've seen many e-mails like yours. We're not exactly sure what the problem is since we haven't personally seen an afflicted system, but we have a couple ideas.

The obvious first guess is that there's some sort of corruption in the basic disk structure. It sounds goofy, but we've had a lot better luck using the command-line chkdsk utility to repair disk problems in XP than *Scandisk*. To run chkdsk, type `chkdsk /f c:` in the Start > Run menu.

A less savory alternative is that someone dumped a large number of files on your machine, then modified the security settings built into NTFS to render them invisible to you. If this is the case, you can use the ntbackup utility to examine the full contents of your drive, even if you won't be able to access the individual files.

A third possibility is that you've attached the contents of another hard drive on your system to a folder on your main drive. If you bind the files to an empty directory, everything will be cool. However, if you bind it to a directory that already has files in it, the results will be unpredictable, and could cause a situation like the one you're describing.

Microsoft details this problem in its Knowledge Base. If you search www.microsoft.com/search for the number 315688, you will be pointed to the appropriate article. If anyone else has experienced these problems, or has an alternative solution, be sure to drop the Doctor an e-mail! ■

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How To...

A step-by-step guide to tweaking your PC Experience

SET UP YOUR OWN GAME SERVER

Learn how you can turn an extra computer into an online gaming host

MAXIMUM PC
TIME TO COMPLETION
00:43
HOURS MINUTES

BY OMEED CHANDRA

You were hooked on *Battlefield 1942* the first time you shot down a Zero and watched it plunge into the depths of the Pacific. But let's face it, there's little fun in playing with the public-server lamers who hang around the airfield waiting for a plane to spawn, only to crash into a mountain 10 seconds after takeoff. Luckily, there's a solution: Set up your own game server so you and your friends can play your favorite multiplayer games free from the company of pimple-faced 13-year-olds.

A game server is just a normal PC that runs special software and is hooked up to a fast Internet connection. When you play a multiplayer game online, your PC connects to a game server, which feeds the data about the match at hand to all the participants. The server keeps track of everything from weapon hits and player movements to the scoreboard and the names of people in the match. Some game servers are operated by game companies, but most are run by fans who have volunteered their hardware and bandwidth in support of their favorite games.

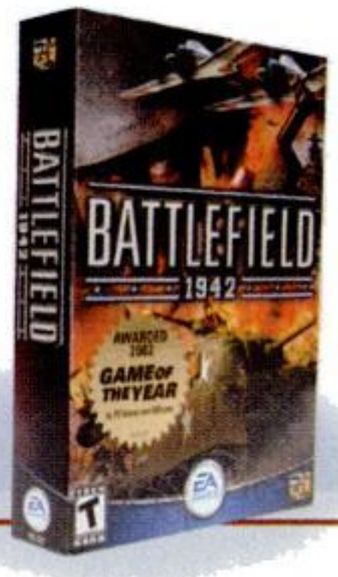
There are two types of game servers: dedicated and listen. A dedicated server runs *only* the server software, not the game itself. Since the dedicated server doesn't have to draw the intense 3D scenes, it uses a lot less CPU power. Listen servers handle their game server duties while simultaneously acting as a client that's participating in the game. Running a client and server on the same machine may be fine for a quick LAN game with a few friends, but if you host more than eight players, listen servers are just too slow. For anyone who plans to host a game server that will be up around the clock, we recommend setting up a dedicated game server, which is what we'll do here.

Do you have what it takes to run your own dedicated game server? Read on to find out!

Ingredients

- A fast Internet connection (dial-up users need not apply)

- A PC with sufficient CPU power and RAM



- Server software for the game you're running (ships with the game and is also sometimes downloadable from the game's web site)

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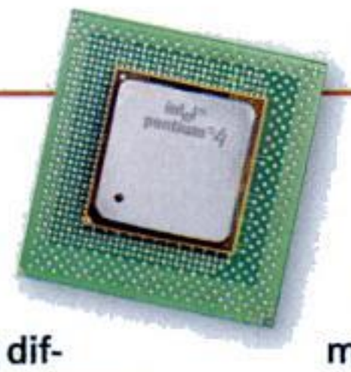
How much of a machine do I need?



Whether you're building a new machine from scratch, or resuscitating an elderly machine to host your game server, there are two things you need: lots of RAM and a fast CPU. The good news is that you can skimp on everything else. You'll need a hard drive big enough to hold your operating system and server files, but it doesn't need to be a 15,000rpm Cheetah drive—any old 7200rpm drive will do. The same goes for your videocard. All you need is a card with working Windows drivers, since it doesn't need to draw the actual game.

The more players you host on your server, the more powerful your hardware must be. Running multiple game servers simultaneously on a single system also takes more juice. However, running three eight-player servers on one machine takes fewer resources than running a single 24-player machine.

Your choice of operating system will make a big difference to your server's performance. Because the network performance of your OS will affect the performance of your game servers, we recommend using a Windows 2000 or Windows XP system for your server. You'll have trouble getting a Windows 98 or ME machine to maintain quality connections for more than eight to 12 people. There's no need to shell out the big bucks for the server versions of Windows 2000 or Windows 2003, either. For the purposes of a game server, they're not much better than a standard Windows XP Pro or Windows 2000 Pro install.

The faster the CPU, the more gamers you'll be able to host.

Each game has different requirements. Just about any machine can serve as an eight-man *Half-Life* server, but it takes an uber-powerful machine to host a 50-player game of *Battlefield 1942*.

Quake III, Unreal Tournament 2003, Return to Castle Wolfenstein, and *Medal of Honor: Allied Assault* fall somewhere between these two extremes. We talked to game server admins at EA and nVidia—who run some of the most popular game servers on the net—to find out exactly what each game requires. For a general rundown on the amount of RAM and CPU-speed requirements for each game, check out the chart on page 66.

What kind of bandwidth is this going to take?

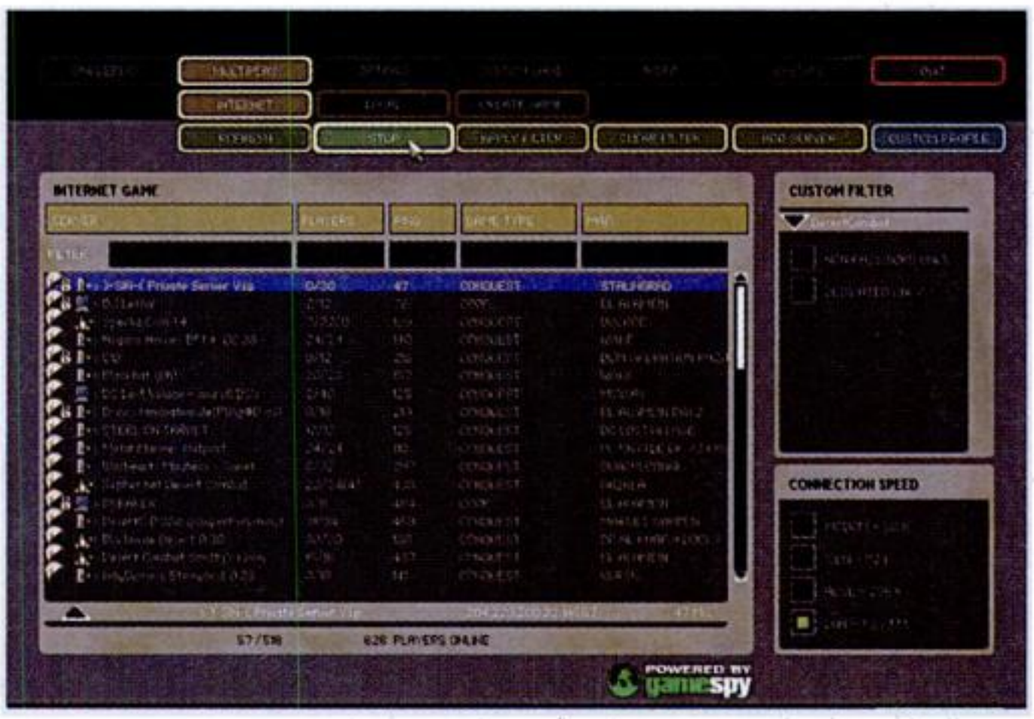
Here's where the real cost of running a game server comes into play. In order to deliver a smooth gaming experience to all participants, you'll need to plug your server into a fast Internet connection—and that can get very expensive. As with the hardware, bandwidth requirements differ among games.

There are a few general rules everyone can follow. A typical ADSL connection provides a whopping 1.5Mbps from the net to your machine (downstream), but just 128Kbps from your computer to the Internet (upstream). Your server will need to be able to receive 24Kbps from each client, and send up to 40Kbps back to each client. Following this rule, most residential ADSL connections should be sufficient to host an eight-player game of *Quake III, Wolfenstein, Half-Life,* or *Medal of Honor (*and our own testing backs this up). Most DSL connections have a maximum theoretical upstream limit of 256Kbps, so they can host a maximum of just eight Internet players.

WHAT ABOUT CABLE MODEMS?

Unfortunately, since cable users share bandwidth with everyone in their neighborhood, they're even less well-suited than DSL users to host a game server. Frequently an empty cable server will have a low ping, but will lag everyone out once enough people connect and eat the available bandwidth. If your home connection doesn't cut the mustard, you could always mooch off the blazing fast Internet connection at your office for free. Not that we'd ever condone such a thing.

We recommend that you use our guidelines from the chart on page 66 as a starting point, then tweak your maximum number of players after you've seen how your connection holds up under a full load. If your server can accommodate a full complement of people without the lag spiking, you can adjust the maximum number of players upward a bit. If, on the other hand, people begin complaining of high pings and lag when your server fills up, you might need to lower the number of players on your server.



Once it's configured properly, your server will show up in-game.

Another way to throttle the amount of bandwidth your server consumes is to configure per-client bandwidth limits. You usually have to configure these limits using a command in the server's config file. By doing this, you'll ensure that a single player with a fast machine can't connect to your server and consume all the bandwidth.

WHAT'S IT GONNA COST?

The bandwidth required to host a good server doesn't come cheap. We checked out prices from several major Internet service providers. Residential DSL connections start at around $40 to $50 per month (depending on your location) for a 384Kbps downstream and 128Kbps upstream connection, which is too slow for a large, robust server. Meanwhile, $60 a month will get you 768Kbps–1.5Mbps downstream and 256Kbps upstream—and if you want an SDSL connection with 384Kbps of upstream bandwidth, you more than double your cost to $120 per month. Finally, if you're considering a T1 line to run that *Battlefield* server on, you better sit down for this: You'll be spending at least $400 per month. Stealing bandwidth from your office suddenly seems mighty tempting, doesn't it?

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Configure your server

Before you can configure your server, you'll first need to get the server software. Virtually every multiplayer game comes with the server software built in, so if you already own the game you want to run a server for, just install it and you'll be set. However, if you don't own a particular game or don't want to install the full version on your server, there are stand-alone dedicated-server files available for *Battlefield 1942* and *Half-Life*. Download them at **www.eagames.com** and **www.planethalflife.com**, respectively.

Once you've installed your server software, it's time to configure the settings. Most games have a dumbed-down graphical interface for changing these settings, but resist the temptation to use it—the GUI often leaves out many important settings. It's best to set up your server using a combination of command-line options and the game's configuration file. By using these files you can regulate the amount of bandwidth each client can use, the number of players that can connect, the number of reserved slots on the server, the cycle of the maps you use, whether friendly fire is on or off, and the length of time each match lasts. The syntax for command-line options and the configuration file varies from game to game; check out the table below for some good online references.

For any game server, you'll find a plethora of options at your disposal. Most of them can be left at the default settings, but make sure you at least change the server name.

Software utilities

At this point, your server should be up and running, but your job isn't over yet. You'll need to deal with the cheaters, team-killers, and other idiots who may spoil your fun. Fortunately, there are loads of utilities out there that make server management easier. The best way to find useful game-specific utilities is by perusing a game's fan sites and forums.

Even though it's no longer supported, *GameHost* can simplify a server admin's job.

We used *GameHost* to manage the *Maximum PC* game servers for ages. It lets you run each server as a service in an NT-based OS, connect to the server console, adjust basic game settings, and stop and restart the game servers; all remotely! The bad news is that it's no longer being updated. For anyone who runs a remote server for one of the supported games (a full list is available at **www.xoanan.com/gamehost**) *GameHost* will certainly simplify your life.

In addition to stand-alone apps, there are hundreds of user-created scripts, applets, and other handy programs to make server administration easier. Whether it's to automatically kick out and ban team killers or prohibit naughty language on your server, the Gamespy network of community sites is a great place to find the tools you need. Point your browser to **www.planet***yourgamehere***.com** and head to the forums. ■

Reference: the game server basics

GAME	CPU/RAM SPECS (16 PLAYERS)	BANDWIDTH (16 PLAYERS)	CPU/RAM SPECS (32 PLAYERS)	BANDWIDTH (32 PLAYERS)	POPULAR MODS	SERVER CONFIG INFO
HALF-LIFE	800MHz, 256MB	640Kbps upstream, 384Kbps downstream	1.4GHz, 512MB	1,280Kbps upstream, 768Kbps downstream	Counter-Strike, Day of Defeat, Natural Selection, Firearms	www.ticclan.com/tutorials/blakfishs-serverguide.html
UNREAL TOURNAMENT 2003	1.2GHz, 256MB	720Kbps upstream, 448Kbps downstream	2.0GHz, 512MB	1,440Kbps upstream, 896Kbps downstream	Troopers: Dawn of Destiny, Jungle Warfare	http://ut2003.trobis.com/server_howto.html
QUAKE III ARENA	1GHz, 256MB	640Kbps upstream, 384Kbps downstream	2.0GHz, 512MB	1,280Kbps upstream, 768Kbps downstream	Rocket Arena, Urban Terror, Orange Smoothie, Weapons Factory Arena	www.3dgw.com/guides/q3a/
MEDAL OF HONOR: ALLIED ASSAULT	1.2GHz, 256MB	640Kbps upstream, 384Kbps downstream	2.4GHz, 512MB	1,280Kbps upstream, 768Kbps downstream	—	www.gameadmins.com/modules.php?name=Sections&op=viewarticle&artid=35
RETURN TO CASTLE WOLFENSTEIN	1.2GHz, 256MB	640Kbps upstream, 384Kbps downstream	2.4GHz, 512MB	1,280Kbps upstream, 768Kbps downstream	—	www.planetwolfenstein.com/server/advanced.shtml
BATTLEFIELD 1942	1.3GHz, 768MB	1Mbps each way	1.5GHz, 1GB	1.5Mbps each way	Desert Combat, Galactic Conquest	www.xtremeoz.com/gameplay/server_commands.cfm

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1999, 2000, 2001, 2002, 2003

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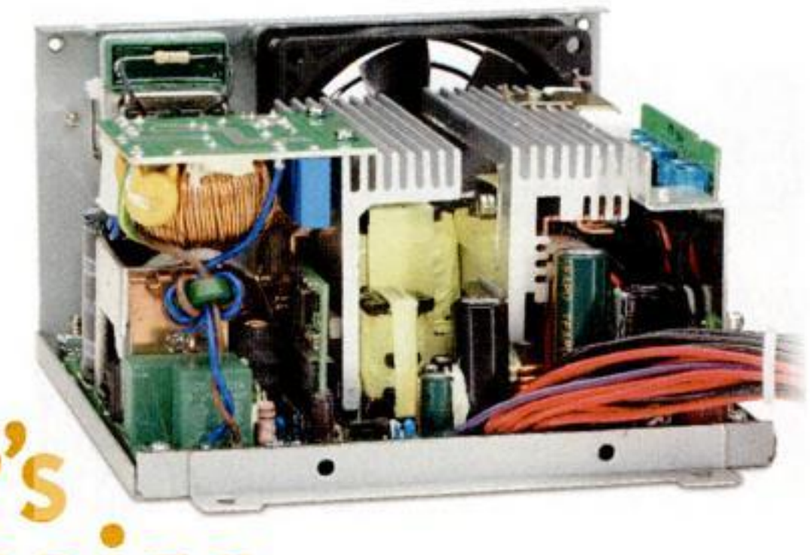

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In the Lab

A behind-the-scenes look at Maximum PC testing

7200 vs. 5400 vs. 4900: Notebook Drives Tested

How much does the latest speed bump really matter?

Clockwise from top left: IBM's 7200, 5400, and 4900rpm hard drives.

For most old notebooks, moldy slow hard drives are the worst bottlenecks. So, to determine just how far the latest notebook hard drives have taken mobile computing, we decided to test the world's fastest notebook drive against slower-rotating competition. If you're a regular reader of this space, you'll remember last month's Lab test, in which we previewed a new Voodoo PC notebook armed with a 7200rpm Hitachi notebook drive.

That's right, Hitachi's 2.5-inch Travelstar E7K60 spins at the speed of its desktop brethren. We pitted this engineering wonder against IBM's Travelstar 40GNX, a 5400rpm drive released earlier this year. A fifth-generation drive, the 40GNX is still considered by many to be a top performer. (At this point, it's important to note that IBM has sold its hard drive division to Hitachi, which now sells the Big Blue drives under the Hitachi banner.) Finally, bringing up the rear, we tested an old IBM Travelstar 8GS. Spinning at 4900rpm, this 8.2GB hard drive is six years old.

To test the drives, we used an IDE adapter and fitted each of the drives to an Asus P4C800 Deluxe motherboard equipped with a 3GHz Pentium 4C, 1GB of DDR400 running dual-mode, and a Radeon 9700 Pro. This hardware config was partnered with Windows XP Pro with SP1. For synthetic benchmarks, we turned to *HD Tach*, and for real-world apps, we used *SYSmark2002*. Though not entirely disk I/O-intensive, *SYSmark2002* will still yield higher scores when running on faster hard drives.

And the results are in . . .

The 5400rpm 40GNX did surprisingly well. The average read speed of the drive was a solid 20MB/s, while max read speeds hit 26MB/s. The 7200rpm Travelstar E7K60 put the slower RPM drive in its place, though. With average read speeds of 30MB/s, the E7K60 was roughly 50 percent faster than the 40GNX. Maximum read speeds for the 7200rpm drive hit 40MB/s.

HD Tach's scores were backed up by *PC Mark*, which showed that the 7200rpm drive offered a 55 percent speed boost over the 5400rpm drive. However, we didn't see these dramatic performance differences when we left the synthetic tests and ran *SYSmark2002*. In the granddaddy real-world testing suite, the 7200rpm drive was about 5 percent faster in the I/O-intensive Office Productivity portion of the benchmark. But we did find the 7200rpm drive to be much faster in the "feel" test. That is, WinXP just "felt" faster while loading, copying, and installing apps. Unfortunately, we can't measure "feeling" in the Lab.

As expected, the six-year-old Travelstar 8GS was stunningly slow, and dragged *SYSmark2002* down by a huge margin. But then again, what would you expect from a hard drive that has average reads of about 6MB/s?

Overall, we think the 7200rpm mobile hard drive—like the 10,000rpm Western Digital SATA drive for desktops—is a welcome change. And Hitachi is also managing do 7200rpm with power consumption just a tad higher than that of its other 5400rpm drives.

DARE TO COMPARE	4900	5400	7200
DRIVE	**TRAVELSTAR 8GS**	**TRAVELSTAR 40GNX**	**TRAVELSTAR E7K60**
Introduced	1997	2002	2003
Model	DYLA-28100	IC25N040ATCS05	HST726060M9AT00
Capacity	8.2GB	40GB	60GB
Cache	459KB	8MB	8MB
Interface	ATA33	ATA100	ATA100
Max Power Consumption	2.6 watts	5 watts	5.5 watts
SYSmark2002	164	287	**296**
SYSmark2002 Content Creation	329	409	**417**
SYSmark2002 Office Apps	82	201	**210**
HD Tach Avg. Read	5.7MB/s	20MB/s	**30MB/s**
HD Tach Max Read	7.6MB/s	26MB/s	**40MB/s**
PC Mark	105	558	**878**

Best scores are bolded.

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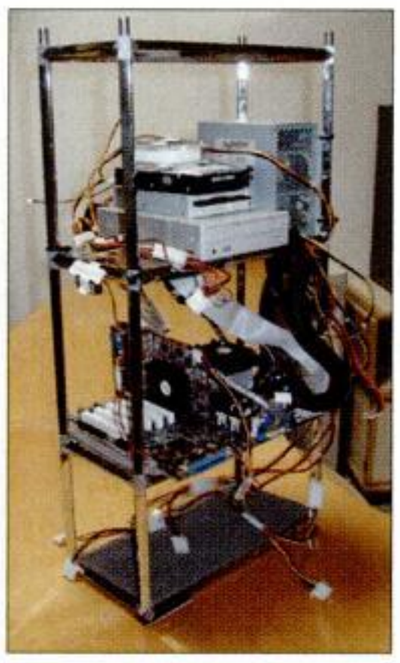
Plantronics M3000

There's no point in a Bluetooth headset if the battery inside it is dead. And let's face it, most of the Bluetooth headsets available have to be charged more often than the phones they're being used with! Enter Plantronics new M3000 headset. It's a bit hefty, but that's because it'll give you 200 hours of standby and eight hours of talk time between charges. With those specs, it wins the award for the longest-lasting Bluetooth headphone we've tested to date. **$110, www.plantronics.com**

Long-Term Road Test

Senfu Tech Station



We didn't think much of the original Senfu Tech Station when we first received it six months ago. It does, after all, look like something you could build from leftover shower curtain rods. The fit and finish is also a little rough, so we needed to do some hammering.

No, we didn't think we'd use it much, but after six months we have to admit that the rickety-looking but solid Senfu Tech Station has won us over. Without a doubt, it is a very effective tool for Lab-based component testing.

Instead of plopping a motherboard down on a cardboard box and laying hardware all around it, the Tech Station lets you build up instead of out. The positioning of the power supply also gives you easy access to the motherboard—it's all very ideal for component swapping. But we did make a few special modifications:

- We zip-tied an 80mm fan to blow air over our boards.
- We taped an LED light onto the superstructure to shine more light on boards.
- We were a little afraid of shorting out our boards on the metal cage, so we added electrical tape to key positions.

The scaffolding you see here (we photographed it in the kitchen!) is the $39 standard Tech Station with the $45 Plus model added to the top of it. Each kit comes with on/off and reset switches, LEDs, and a tiny speaker that can be plugged into the front-panel headers of a motherboard. All told, the Senfu Tech Station is perfect for people who need a stable, convenient platform for testing and troubleshooting motherboards and other hardware. The Stations are a little hard to find, but we got ours at Highspeedpc.com.

Best of the Best

As of October, 2003

This month there were no changes to our top hardware recommendations. This even includes our pick in the controversial P4 mobo category. We still recommend the Intel D875PBZ—we have strong indications it will work with at least the initial version of Intel's upcoming Prescott CPU. We're not so sure about any other companies' P4 boards. If you're buying an 875P chip motherboard for your P4, you'll want to make sure it supports the increased voltage requirements of Prescott.

High-end videocards:
nVidia GeForce FX 5900 Ultra/ ATI Radeon 9800 Pro 256

Budget videocard:
ATI Radeon 9600 Pro

Do-everything videocard:
All-in-Wonder Radeon 9800 Pro

Soundcard:
Sound Blaster Audigy 2 Platinum

Serial ATA hard drive:
Western Digital 360GD Raptor

Parallel ATA hard drive:
Western Digital WD2500JB

CD-RW drive:
Plextor PlexWriter Premium

DVD burner:
Pioneer DVR-A06

LCD monitor:
Sharp LL-1820

High-end CRT monitor:
Sony F520

Budget CRT monitor:
Cornerstone P1750

P4 motherboard:
Intel D875PBZ

Athlon XP motherboard:
Asus A7N8X Deluxe Rev 2

Portable MP3 player:
iPod 30GB

Photo printer:
Epson Stylus Photo 1280

Pocket PC PDA:
HP iPaq 5450

Palm OS PDA:
Palm Tungsten C

5.1 speakers:
Logitech Z-680

4.1 speakers:
Logitech Z-560

2.1 speakers:
Klipsch Promedia 2.1

Our current gaming favorites: *Planetside, Star Wars Galaxies, Battlefield 1942: Desert Combat Mod, Tron, Midnight Club 2*

THE MAXIMUMPC LAB PROUDLY ANNOUNCES:

Happy Hour Friday!

Our team of mixologists presents a sampling of silicon spirits.

The RDRAM Rickey

An exotic neo-Asian mixture of water-cooling fluid, two sticks of imported Taiwanese RDRAM, and a dash of Arctic Silver (which can be omitted for those who prefer their cocktails "dry"). Stir, drink, and toast to fallen chipsets past.*

The Athlontini

No, it's the *other* Thunderbird. In a mixing glass, add ice, distilled water, and a T-Bird-class Athlon processor. Shake vigorously until the Athlon's substrate has cracked, then strain away the liquid, and pour the broken CPU into a chilled cocktail glass. Rub mouse wax over the rim of the glass, and serve with an olive garnish. To your health!*

3D Shooters

No-nonsense shots for fellas who like their soda pop straight and their benchmark results raw. Tip back your head, and let the good times flow—first the Dew, then the ill-tempered bite of four-year-old 3D graphics.*

**This cocktail contains dangerous ingredients. Not for human consumption.*

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Polywell 1100A

AMD beats Apple to the 64-bit desktop (sort of)

Polywell's Opteron falls flat compared with higher-clocked chips.

Apple likes to claim that its new G5 is the first 64-bit computer for consumers, but some would argue that Polywell beat Apple to the 64-bit consumer space, if only on the basis of a technicality. The G5 has yet to make an appearance in the Maximum PC Lab, but for the last month we've been watching Polywell's 64-bit desktop machine quietly churning through benchmarks.

The CPU in the Polywell—an AMD Opteron—has been running in its 32-bit mode, but the machine is indeed 64-bit capable.

AMD designed the Opteron for high-end server and workstation duties, but Polywell put the CPU in a desktop machine because the chip can run both 32-bit and 64-bit code. Windows XP isn't yet 64-bit capable, so if you want to rock Opteron's 64-bit world, you'll have to run it with a Linux server OS. Would the typical *Maximum PC* reader really want to do this? Probably not, because there are currently no consumer apps that run in 64-bit. Still, future OSes and apps will run in 64-bit, and as a result, they'll be able to address terabytes of memory.

AMD's 32/64-bit approach is really just a way to prepare for the demands of the future. The inevitable transition from 32- to 64-bit code will be a rough one, so AMD figures it can erase some growing pains by creating a computing platform that's ready for any task one might encounter. Opteron represents the server/workstation side of the AMD vision, and in next month's issue we'll show you Athlon 64, AMD's 32/64-bit consumer-level, desktop proc.

But for now, let's look at Polywell's misguided Opteron offering. In the form we reviewed this month, the Opteron 144 ticks along at 1.8GHz, has 1MB of L2 cache, and features AMD's integrated memory controller. Traditional memory controllers are contained in a motherboard's northbridge chip and run at speeds between 400MHz and 800MHz. But with the Opteron (and soon Athlon 64), AMD has placed the controller directly in the CPU core. While this strategy hurts flexibility—you can't switch your CPU to a motherboard running a different memory type—it also lets the memory controller run at the CPU's clock speed. In our Polywell box, that's a smokin' fast 1.8GHz.

This Polywell box could run a 64-bit Linux OS if we asked it to, and that's just peachy. But the configuration we received was running WinXP, and got beaten badly in all CPU-related benchmarks. Compared with a similarly configured 3.2GHz P4 machine from Velocity Micro (reviewed in August), the Polywell 1100A was 24 percent slower in *SYSmark2002*. In the Adobe *Premiere* video-encoding test, where lowly 2800+ Athlon XPs always beat the fastest Pentium 4s, AMD's 1.8GHz Opteron just tied the 3.2GHz Velocity Micro. The Polywell was also 30 percent slower in *MusicMatch* encoding.

We suspect that the Opteron was being handcuffed by its subsonic clock speed and use of registered DDR333 memory. And, of course, our benchmarks are aimed at stressing desktop performance. We're sure there are plenty of server apps that would just love to get their claws on the Opteron's 1MB of L2 cache and integrated memory controller.

AMD has been stressing that Opteron shines brightest in servers, so we can't recommend Opteron for desktop use. Athlon 64 may be a different story entirely, so check back next month.

— GORDON MAH UNG

UNDER THE HOOD

THE BRAINS

CPU	1.8GHz AMD Opteron 144
Mobo	nForce3 Pro
RAM	1GB registered DDR333
I/O ports	Four High Speed USB 2.0, one Fast Ethernet, two serial, one parallel, game port, mic in, line in, three analog audio out
LAN	nVidia 10/100 Ethernet onboard

DISPLAY

Videocard	nVidia GeForceFX 5900 Ultra

STORAGE

Hard drives	200GB Western Digital WD2000JB, two 36GB Western Digital WD360GD SATA running on High-Point Rocket RAID card in RAID 0
DVD-ROM	Sony DRU-510A
CD-RW	Plextor 52x/24x/52x

AUDIO

Soundcard	Sound Blaster Audigy 2
Speakers	Creative Labs Inspire 6.1

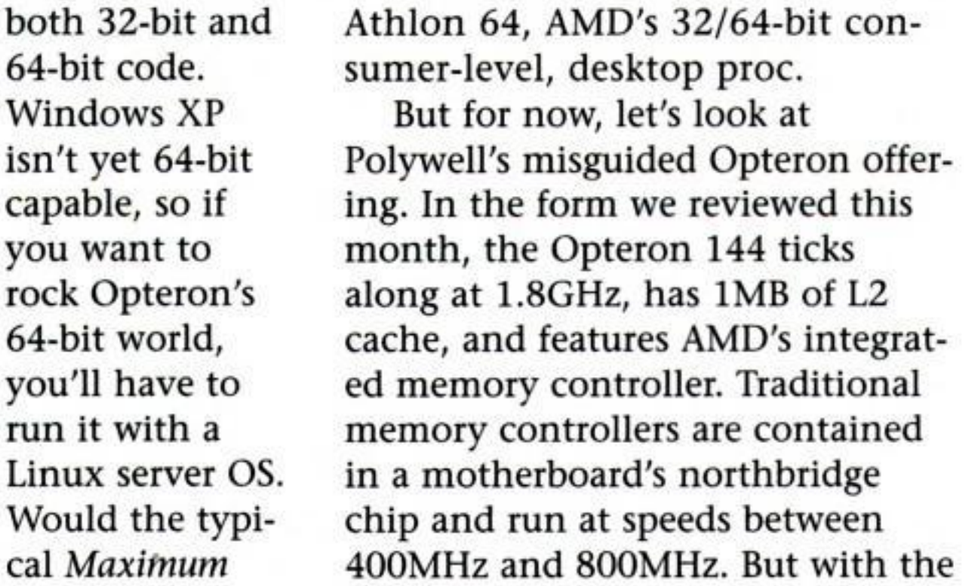
FINE DETAILS

Case	Platinum 10-bay aluminum
Fans/extras	Four 80mm, case window, cold cathode light, media reader
Other	WinFast TV Tuner and FM card
Mouse	Microsoft Wireless MultiMedia Cordless Optical
Keyboard	Microsoft Wireless MultiMedia Cordless

BUNDLE

Windows XP Professional, PowerDVD, Video Studio 6, RecordNow DX, MyDVD, WinFast PVR FM, Microsoft Works

BOOT: 285 sec. **DOWN: 8 sec.**



Our zero-point system includes: an Intel D850MV motherboard, a 2GHz P4 CPU, 512MB PC800 RDRAM, a GeForce4 Ti 4600 videocard, and a Western Digital 1000BB hard drive (2MB cache).

MAXIMUM PC VERDICT 5

+ $64,000

Comes with a good supporting cast of components.

– 64 CENTS

Places third behind P4 and Athlon XP systems.

$3,388, www.polywell.com

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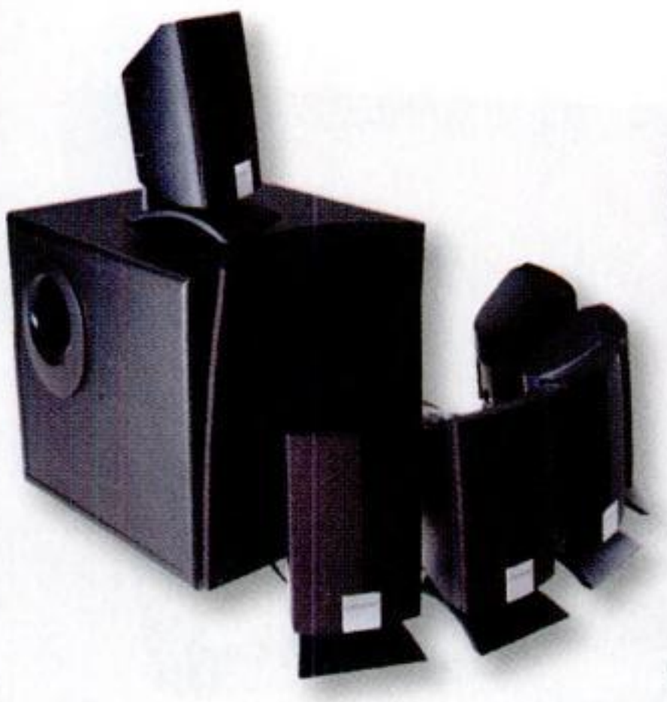
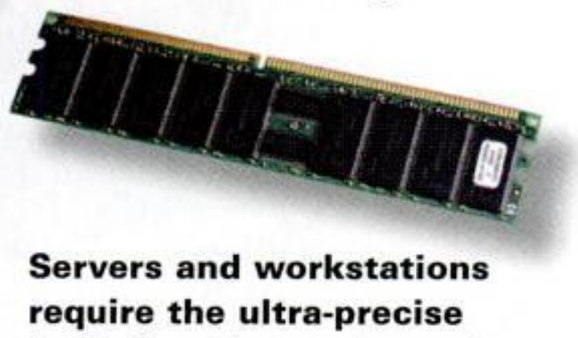


The Inspire speakers and Audigy 2 soundcard give you an additional rear channel that goes directly behind your melon.

The nifty media reader integrates a floppy drive so you don't have to consume two 3.5-inch bays.



Servers and workstations require the ultra-precise buffering that registered DIMMs provide.

Opteron vs. Athlon 64: What's Different?

➤ The Opteron runs dual-channel DDR memory. Athlon 64 will run lower-performance single-channel memory (at least at launch).

➤ The Opteron requires expensive and hard-to-find registered memory; Athlon 64 doesn't. Registered memory uses a small chip on the module to regulate the flow of data. This provides the level of error control that businesses need for servers, but is overkill for home users.

➤ Athlon 64 will inevitably be introduced with faster clock speeds.

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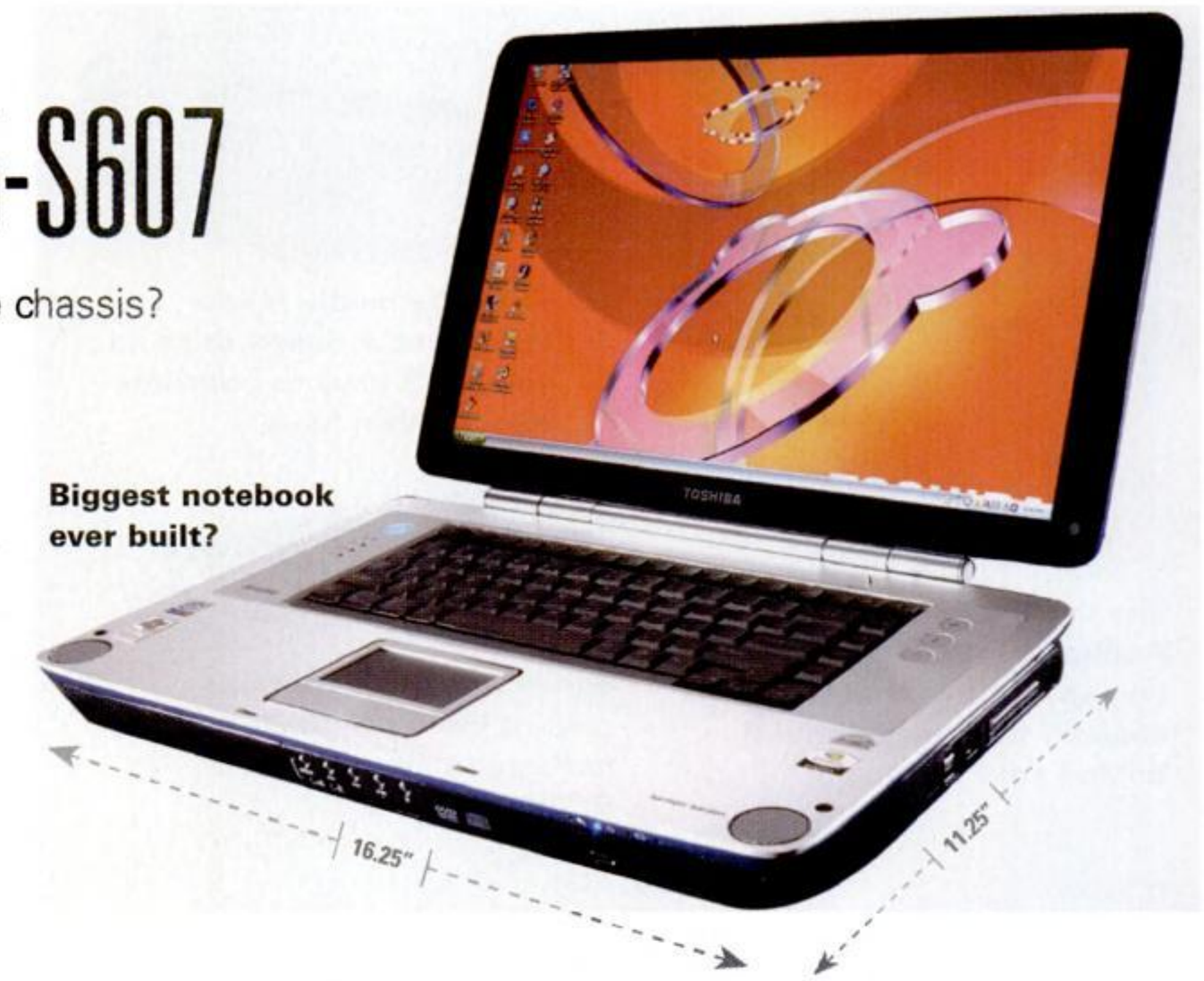
Toshiba Satellite P25-S607

Who stuffed a desktop PC in this notebook-like chassis?



Notebook vendors usually like to dazzle us with the most portable notebooks imaginable, but Toshiba flouted convention when it sent us the Satellite P25-S607.

The Satellite's massive size is somewhat unavoidable because the notebook packs a breathtaking 17-inch display. It's not the first 17-incher we've seen; Apple's Powerbook G4 features the same size screen. And with a screen resolution of 1440x900, the new Satellite doesn't offer the most LCD pixels in the PC notebook arena; Dell's Inspiron 8500 has more in its 1920x1200 screen. The Satellite's screen, however, is much more legible thanks to its sheer size and lower resolution.

The desktop-like display is complemented by a full desktop CPU—a 2.8GHz Pentium 4 with Hyper-Threading and an 800MHz frontside bus. All this wonderfulness is paired with a no-excuses Intel 865PE chipset. Toshiba properly chose to run the RAM in dual-channel mode, just like anyone would in a desktop machine, albeit at DDR266 levels.

Dual-channel memory and an 800MHz bus give this Toshiba a big performance boost over competitors. The Satellite has 100 percent more available memory bandwidth than single-channel 845 notebooks we've tested, and 62 percent more than Voodoo's M460 notebook, which we previewed last month.

Toshiba should have gone all the way with nVidia's GeForce FX Go5600 chip or a top-end ATI chip, but instead it reached for the GeForce FX Go5200, which offers anemic 3D gaming performance. Despite a 400MHz CPU clock-speed advantage over Dell's Inspiron 8500, the Satellite hit just 6,999 3D Marks in *3DMark2001 SE,* which is 7.5 percent behind the 6-month-old Dell's score of 7567. Voodoo's M460, armed with an ATI Radeon Mobility 9600 chip, scored 9,258. We also ran into a hitch with our *Quake III* benchmark. Because the Satellite's screen only supports 1440x900, we couldn't run our benchmark at its standard 1280x1024.

But the mongo-large notebook does marvelously well as a non-gaming entertainment center. The wide-aspect screen is just perfect for DVD movies. Also, with Windows XP Media Center built in, and the bundled TV tuner in one of two multibays, you can watch and record TV right out of the box. Video can be committed to disc via a Panasonic 2x DVD-R/1x DVD-RW drive.

Using the Atheros AR5001X chip, this notebook features built-in support for 802.11b, g, and a. We also found the Wi-Fi reception to be good overall. The notebook doesn't feature a 7200rpm hard drive like the one Voodoo let us preview last month, but it does have Toshiba's own 5400rpm drive with a 16MB buffer.

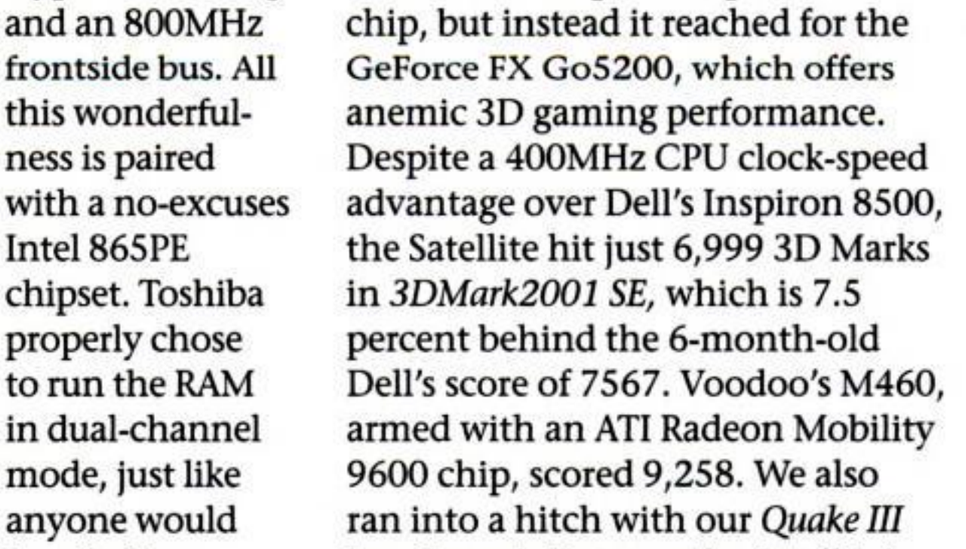
Application performance was excellent, and we were also impressed that the Satellite weathered our battery-life test for a whopping 133 minutes.

The only things that deny this big baby from a Kick-Ass award are the lack of a serious graphics chip and 7200rpm hard drive. Sure, you'd expect us to be harder on a notebook with lame 3D, but this thing is awesome in traditional multimedia.

—GORDON MAH UNG

UNDER THE HOOD

THE BRAINS	
CPU	2.8GHz Pentium 4C with Hyper-Threading and 865PE/ICH5 chipset
RAM	512MB DDR266 (two 256MB DIMMs running in dual-channel mode)
I/O ports	Parallel, four Hi-Speed USB 2.0, Fast Ethernet, S-video out, video out, line in, mic, headphone
Modem	Toshiba V.92
LAN	Atheros AR5001X 802.11a/b/g, Realtek RTL8139 Fast Ethernet
DISPLAY	
Video chip	nVidia GeForce FX Go5200 (200MHz core / 203MHz DDR)
LCD	17-inch (1440x900@32-bit)
STORAGE	
Hard drive	Toshiba MK6022GAX 60GB (5,400rpm, 16MB buffer)
CD-RW/ DVD-ROM	Panasonic UJ-811 (2x DVD-RAM, 2x DVD-R, 1x DVD-RW, 16x CD-R, 8x CD-RW, 8x DVD-ROM, 24x CD-ROM)
Other	SD card reader, 4-port FireWire A
SOUND	
Audio chip	Realtek AC97
TIPPING THE SCALES	
Lap weight: 9.80 lbs.	
Carry weight: 11.15 lbs.	
BUNDLE	
Windows XP Media Center, Norton Antivirus, Microsoft Works 7.0, WinDVD 4, Drag's Drop CD+DVD, Quicken 2003 New User Edition, DVD-MovieAlbum CopyTool, DVD-MovieAlbumSE, MyDVD 4.5	
BOOT: 25 sec.	**DOWN: 22 sec.**



Our zero-point notebook is a Dell Dimension 8200, and includes a 1.7GHz P-4M CPU, 256MB DDR266, a 64MB 128-bit DDR GeForce4 Go graphics chipset, and a 5400rpm IBM Travelstar 60H hard drive.

MAXIMUM PC VERDICT 9

SENNHEISER

Solidly built. Boasts dual-channel memory. The big screen is a joy on the eyes and great for movies.

OPTIMUS

The GeForce FX Go5200 is too slow for a notebook of this stature.

$2,700, www.toshiba.com

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- > 120GB 7200RPM Serial ATA-150 Hard Drive 8MB Cache
- > NVIDIA® GeForce™ FX 5900 Ultra 256 MB Graphics Card
- > a.i. Aluminum Heatsink Hard Drive Cooler
- > Sony Black 16X/48X DVD-ROM Drive
- > Sony Black 52X24X52 CD-RW Drive
- > Creative Sound Blaster® Audigy 2™ 6.1 Audio
- > High Performance System Case Cooling Fan Options
- > Microsoft® Windows® Professional Edition
- > a.i. live online technical support system
- > 1-Year Toll-Free 24/7 Phone Support
- > 1-Year At Your Home Warranty
- > Customized UV Reactive Paint
- > Limited Edition numbered series available
- > a.i. Cold Cathode Lighting System (UV Availability)
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Lite-On 52/32/52 CD Burner

Why rewriting is no longer biting

Lite-On—still no looker, but she's a hell of a cooker.

We never dreamed we'd be singing the praises of CD rewriting, but then again, we never thought we'd see the Terminator on our voting ballots, either.

But here we are. We might not all be in agreement when it comes to Arnold Schwarzenegger, but there is consensus about 32x rewriting speeds: They rock. This month, for the first time, we wrote 647MB to a CD-RW in less than three minutes—2:57 (min:sec), to be exact. 32x CD-RW hardware isn't exactly new, but 32x media has taken its sweet time to arrive. Now that it has, we're impressed. We might actually stop wasting our 700MB CD-Rs just to transfer files to and fro.

It's too bad, though, that the rewriting breakthrough comes so late in the game. We've gotten used to our USB keys for jockeying files from PC to PC. Nonetheless, 32x rewriting does represent something of a "victory" for CD burners, because other CD-RW specs seem to have hit their ceilings.

Rewriting at 32x wasn't Lite-On's only surprise. The drive case shrunk down to a mere 6.75 inches long. That's almost an inch shorter than previous Lite-Ons, clearly a nod to the vast number of folks adopting low-profile or Shuttle cases. (We're particularly sensitive about this subject. When we built our $11K Dream Machine in September, an enormous cooling apparatus forced us to Dremel a piece out of our Plextor Premium drive just to make it fit in the drive bay! We should also note that MSI's drive has gone low-pro as well.)

The rest of Lite-On's benchmarks yielded neither surprises nor disappointments. We extracted 74-plus minutes of audio from a commercially pressed CD in a category-leading 2:20. We also burned a full data CD in 2:39, and observed just slightly less than a full 40x write transfer-speed average across the span of the entire disc. (It wasn't too long ago that you'd be lucky to achieve 40x maximum, at the outer edges of the disc.)

Lite-On quickly built a name for itself making quality drives for suspiciously low prices. That tradition continues.

—LOGAN DECKER

BENCHMARKS

Average data transfer (MB/sec)	5.8
Average drive rating	39.36x
Random/full-stroke seek (ms)	84/154
Audio extraction (min:sec)	2:20
Data CD burn (min:sec)	2:39
CPU utilization (at 8x)	11%

The audio extraction test uses a commercially stamped 74:32 minute audio CD. The data-CD burn test uses the bundled applications to create a 700MB CD-R. All tests were performed using Verbatim media, except where indicated.

THE BUNDLE

Ahead *Nero 5.5*, Ahead *InCD* (packet writing), ahead *NeroMix*

MAXIMUM PC VERDICT 9

+ BELLY DANCE

Same high-quality drive for the same low price, but now in a tidy case perfect for small systems.

– RIVERDANCE

Comes with *Nero 5.5* instead of the new *Nero 6*. Seek times could be better. Drive tray is rattly.

$70 (MSRP), www.liteonit.com

MSI 52x CD Burner

Giving latecomers a good name

Like the PlexWriter, the MSI boasts a reinforced front bezel in case of a disc shatter.

MSI dived into the optical drive scene just as others—such as Yamaha—were bailing out. And it does seem odd that MSI, best known for its mobos, would join the CD-RW fray, especially considering that pure CD burners are losing relevancy in this age of CD/DVD combo burners.

But if you think that MSI is simply looking to crank out crappy drives before the CD burning category disappears altogether, you are so very wrong. Our benchmark results show that MSI can hold its own against some of the best CD-RW drives available. In fact, we can only conclude that either optical drive technology is really, really easy to do right, or that manufacturers are realizing that consumers will only purchase the highest-performing drives available.

Of course, it's also entirely possible that MSI bought a whole bunch of drives from some other vendor, and then slapped the MSI label on top, but who's complaining?

In almost every benchmark, the MSI drive ran neck and neck with Lite-On's 52x drive (reviewed above). We burned a full 700MB data CD in 2:41 (min:sec), which is just two seconds behind the Lite-On 52x. The MSI also finished a CD-RW in 2:56, a second faster than the Lite-On.

The MSI was actually beating the Lite-On during audio extraction until the very last track (which is always the most difficult track from which to rip audio). It slowed down to extract the last minute of the 74-minute CD, resulting in a final extraction time of 2:42. Nothing to get upset about (very few audio CDs run past 74 minutes), but the MSI was ultimately 22 seconds behind the Lite-On, nonetheless.

In the final analysis, we had to dock the MSI a point for its audio ripping gaffe. And, we're partial to the orgy of features offered by the 52x Plextor Premium. But the Premium commands a premium price, so budget shoppers won't be disappointed by either drive on this page.

—LOGAN DECKER

BENCHMARKS

Average data transfer (MB/sec)	5.8
Average drive rating	39.38x
Random/full-stroke seek (ms)	75/178
Audio extraction (min:sec)	2:42
Data CD burn (min:sec)	2:41
CPU utilization (at 8x)	6%

The audio extraction test uses a commercially stamped 74:32 minute audio CD. The data-CD burn test uses the bundled applications to create a 700MB CD-R. All tests were performed using Verbatim media, except where indicated.

THE BUNDLE

Ahead *Nero 5.5*, Ahead *InCD* (packet writing), ahead *NeroMix*

MAXIMUM PC VERDICT 8

+ JIMI HENDRIX

We could do worse than to have yet another great drive at a low cost like this one

– JIMMY FALLON

As with the Lite-On, seek times could use some improvement here.

$45 (estimated street), www.msi.com.tw

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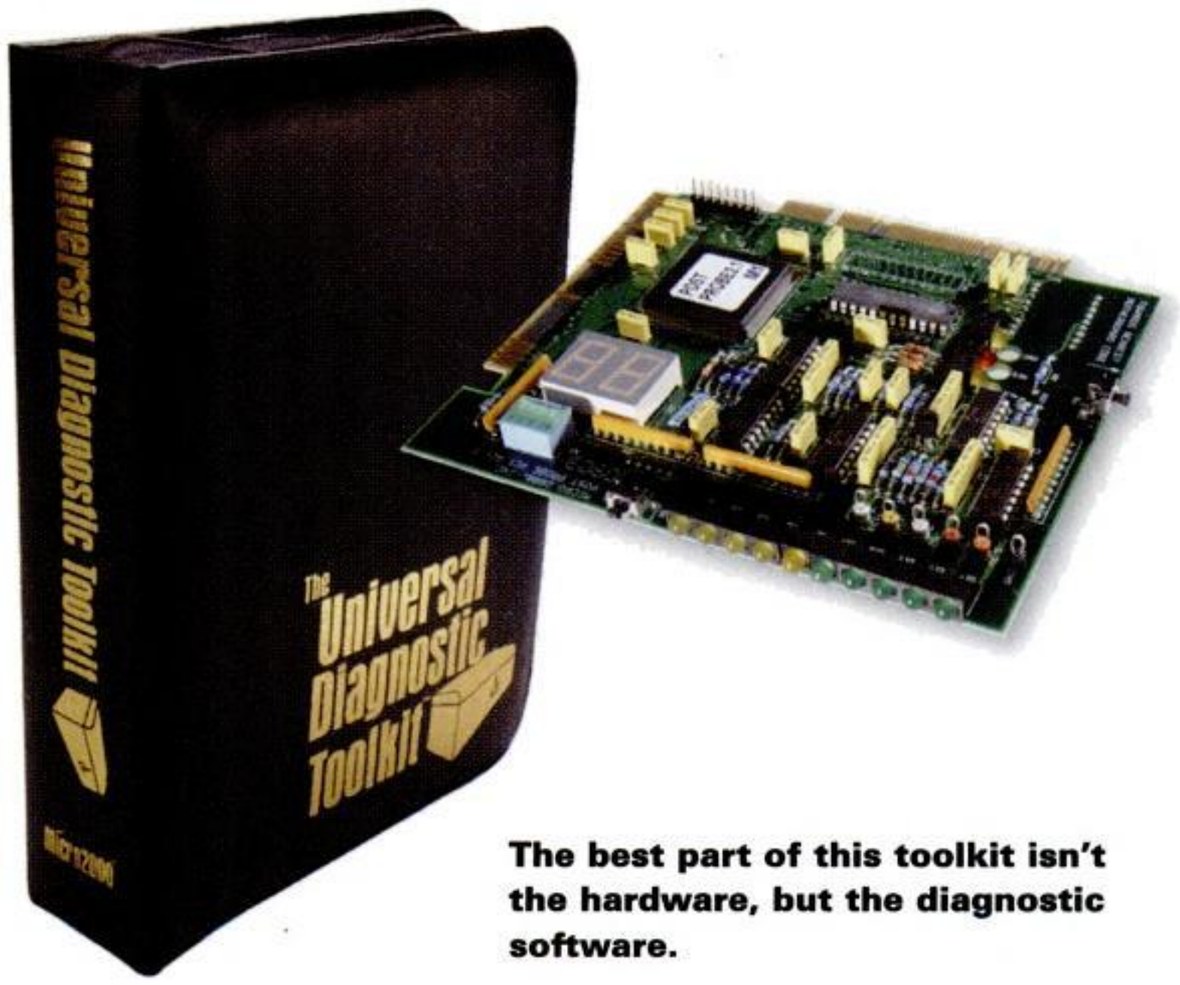
Micro 2000 Universal Diagnostic Toolkit

A great POST card kit struggles for relevancy in the modern world



The best part of this toolkit isn't the hardware, but the diagnostic software.

Your PC won't boot, so you begin swapping parts to identify the offending hardware. Sound tedious? Then you might want to consider a POST card kit, like Micro 2000's Universal Diagnostic Toolkit. Unzip the included vinyl case, and you'll find a POST card, loopback connectors for testing serial and parallel ports, Micro 2000's *Micro-Scope* diagnostic software, and comprehensive manuals for the entire bundle. It's a broad set of tools, but in this day and age, the Universal Diagnostic Toolkit is less useful than you might expect.

Plugging into either a PCI or ISA slot, the POST card reads error codes generated by your motherboard and outputs them to a two-digit display, making it easy to pinpoint any problems that would prevent a PC from booting. The manual explains error codes for many BIOSes, but most of the codes our card generated were listed as "Reserved," forcing us to look at the documentation that came with our mobo for details. And herein lies the rub with all POST card kits: Most modern motherboards already include extensive self-diagnostic capabilities—some type of function that generates error codes (visual readouts, beep codes, even human-voice reports), along with a manual that explains what all the codes mean. For this reason, the best feature of Micro 2000's POST card is probably its power supply test pins, which can be hooked up to a voltmeter to detect problems with a PC's power circuitry.

Micro 2000's software is the most valuable part of the bundle. You boot off of the *Micro-Scope* CD, so any diagnostic red herrings introduced by the OS are bypassed. The included utilities do everything from repairing corrupted FAT disk partitions to testing for defective memory, CPUs, and videocards. *Micro-Scope* can also provide a full spec breakdown of the system it's running on. For the most part, its reports are accurate, but the software misidentified an 8x AGP videocard as a 2x AGP part, and reported that a 133MHz frontside bus was running at 66MHz.

The Universal Diagnostic Toolkit is a nice luxury if you have $898 to throw around ($698 if you mention *Maximum PC*), but that's is a high price for something that may be redundant to a power user's existing complement of tools. Perhaps the days of *all* POST cards are numbered.

—OMEED CHANDRA

MAXIMUM PC VERDICT 7

+ POST COCOA PEBBLES

Lets you easily test for problematic power. Useful software diagnostics. Everything works as advertised.

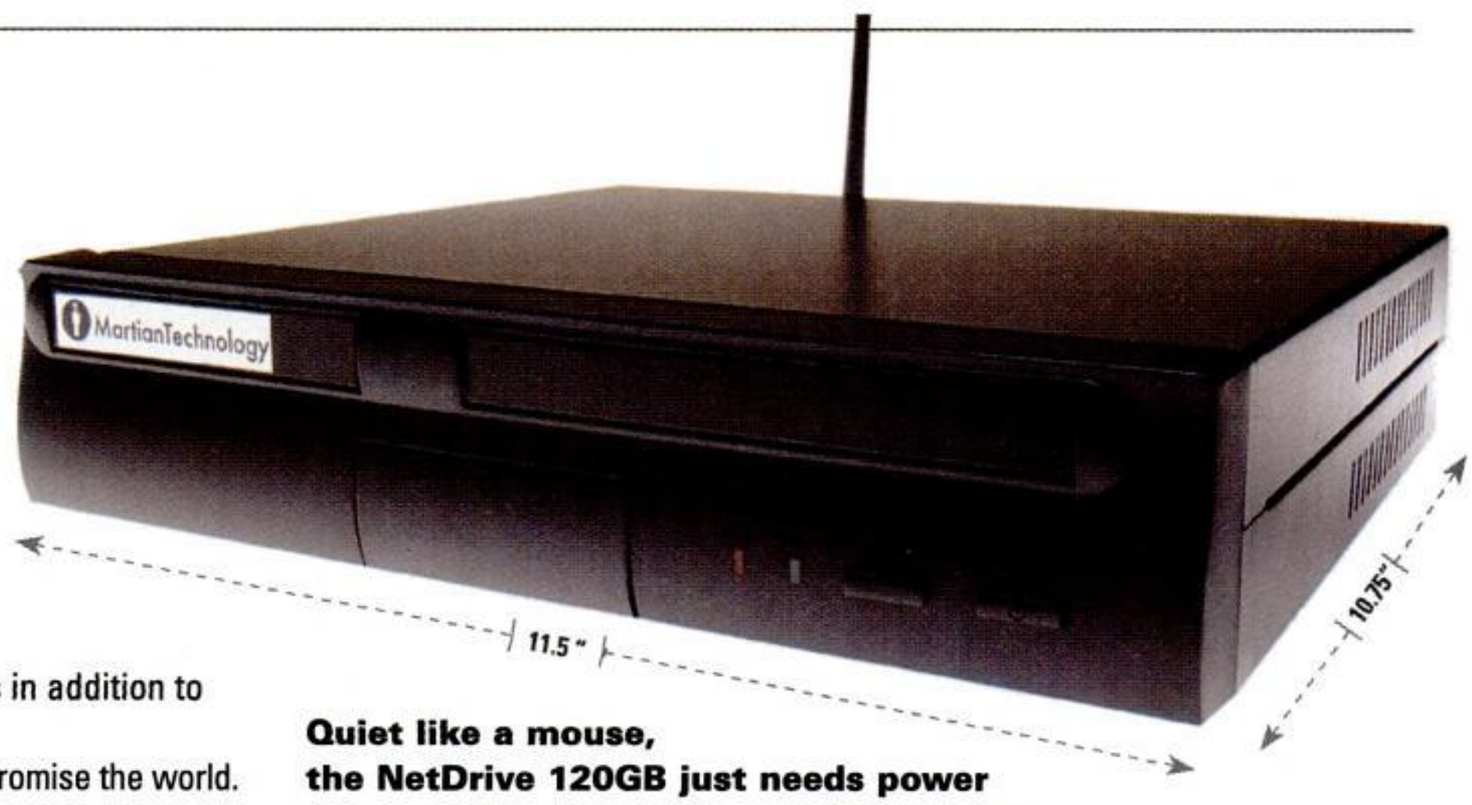
– POST 100% BRAN

A POST card is of limited use with modern mobos. Extremely expensive.

$898, www.micro2000.com

Martian NetDrive Wireless 120

Small system silently serves songs and slick sundries



Quiet like a mouse, the NetDrive 120GB just needs power to serve files across your Wi-Fi network.

We've tested a number of "server-in-a-box" kits designed for small home networks and modest web serving duties, but until the Martian NetDrive was seated at its table in Chez Maximum PC, we hadn't tested one that is virtually silent, nor one that supports 802.11b wireless connections in addition to standard 10/100 wired connections.

Unlike competing personal servers, the NetDrive doesn't promise the world. It contains no fancy router, no mail server, and no web server. The NetDrive is simply a small formfactor, Linux-based home network server with a low-power CPU, a 120GB hard drive, and a Wi-Fi card. In fact, the only thrills the NetDrive offers is USB printer-sharing. Simply plug a printer into one of the NetDrive's USB ports, and you can print to that printer from any machine on your network.

The NetDrive's configuration is painless. Connect it to your Ethernet LAN, give it some juice, and it will be up and running for any network that uses a DHCP server to dole out IP addresses. Once the NetDrive is running, you can point your file browser to "//martian/" and you'll be connected to the box, ready to begin copying files. Most networks will require no configuration at all.

If you want to move the NetDrive to an out-of-the-way location—one that's not hard-wired to the network—all you have to do is enter your wireless LAN's SSID and encryption key into the NetDrive's web-based interface, and it will work exactly as if it were connected by wires.

The NetDrive ships with a utility to stream music to the SliMP3 digital audio streaming device, and music stored on the NetDrive automatically shows up in *iTunes* on OS X Macs. But the really impressive thing is that the NetDrive doesn't require any active cooling. That's right, the Martian box doesn't have a single fan, yet it stayed cool during 24/7 testing. We measured temperatures everywhere we could reach, but found nothing hotter than 98 degrees Fahrenheit. The NetDrive also ran fine even inside a hot, stuffy closet.

The Martian doesn't have a lot of fancy, schmancy tricks, but it does do exactly what it promises, well.

—WILL SMITH

MAXIMUM PC VERDICT 7

+ A MOUSE

A small, ultra-quiet home server and print server that will work on Ethernet or Wi-Fi.

– A HERD OF BUFFALO

A net-connected Linux box should do a lot more than just share files and printers.

$480, www.martian.com

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He disappeared five days ago. He's gotta be on Level 928 by now.

He had good grades. Nice parents. A bright future. But then he built a mind-altering gaming machine and escaped to a different reality. A reality where victory is vastly more important than sleep, food, or piddling distractions like 'the real world.' Good thing he's got our new P160 in his arsenal. Carved out of supremely strong anodized aluminum, our ultimate gaming case packs ten drive bays. A swiveling control panel. And a host of ultra-quiet features including a low-speed 120mm fan and isolated HDD bays. Which should satisfy even the most ferocious gamer. So get a P160. And escape to a more stimulating reality. Now that's *the Power of You.* To view our full line of products, visit www.antec-inc.com.

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Creative MegaWorks THX 6.1

Now with more satellites than Mars!

Creative insists that the sixth satellite for the MegaWorks is called the "rear center," but we'd rather call it Saturn.

We've been hard on Creative speakers in the past. The last Creative rig we tested, the MegaWorks 5.1D, received a paltry 6 verdict, thanks to a sub-par subwoofer. The non-ported sub on the 5.1D belched when we played low frequencies at high volumes.

For the new 6.1 MegaWorks—which adds a rear center satellite to mirror the standard front center sat of a 5.1 system—Creative's engineers totally redesigned the flatulent subwoofer. The new sub adds a side port, which helps relieve intra-chamber pressure created by the 8-inch downward-firing driver. The six satellites, meanwhile, use the same 3.5-inch driver that older MegaWorks speakers sport. To control this array of speakers, there's a new wired remote control that lets you tweak satellite levels, sub level, and bass/treble. The wired remote includes a headphone jack, which we consider a must-have on a set of $400 speakers.

Of course, even a convenient headphone jack can't save a bad-sounding speaker rig from a drubbing in the *Maximum PC* audio tests. In our 20Hz-to-22kHz sweep test, the MegaWorks' new sub passed with flying colors, but we were a bit disappointed by the high-end response of the satellites. They stopped producing recognizable tones at around 19kHz. That's within the acceptable range, but isn't as good as most other high-end speakers we've tested. The MegaWorks excelled in our pink-noise tests, even when cranked to maximum volume. The speakers create a tight, rich sound field within their sweet spot—as PC speakers should.

We regularly play DirectSound3D games with 4.1 and 5.1 rigs, but this 6.1 gaming rig was a first for us. The additional rear center channel reinforces the sensation that in-game action is really going on behind you. (With a 5.1 system, it frequently feels like sounds are coming at you from both sides, but not from behind.)

We're disappointed that the MegaWorks system doesn't ship with a digital decoder, but rumor has it that Creative will offer one by the time you read this.

With its sixth channel, the MegaWorks THX 6.1 is an excellent speaker rig, and is definitely competitive with Klipsch and Logitech offerings.

—WILL SMITH

MAXIMUM PC VERDICT 9

+ MATT FOLEY

The sixth satellite Creative added to the MegaWorks really enhances DirectSound3D games.

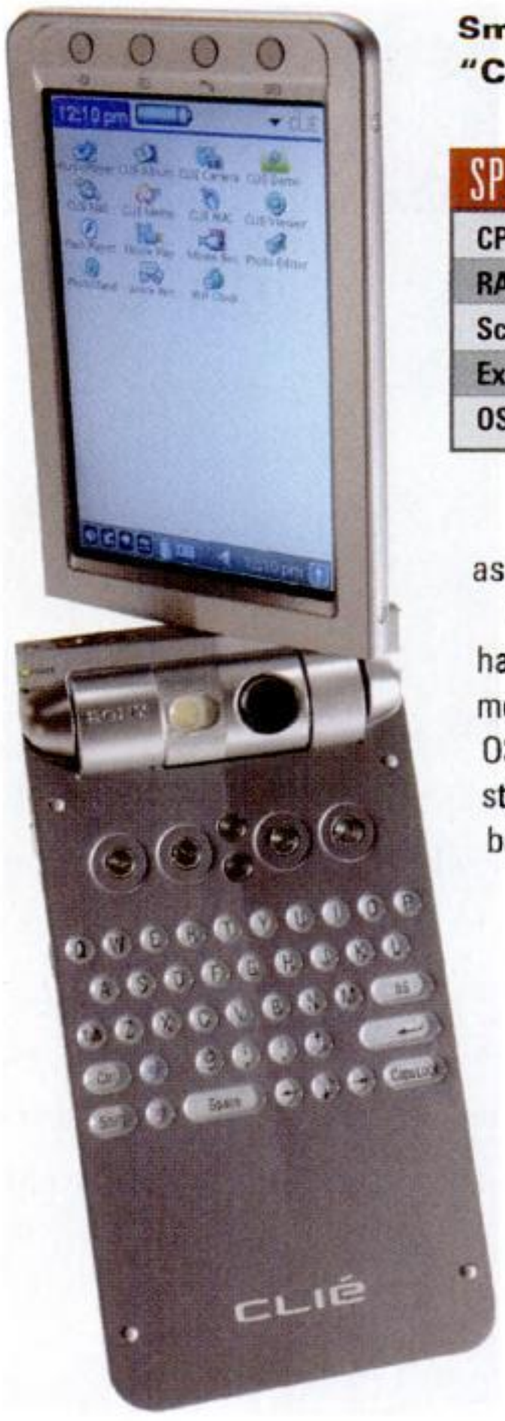
– TONY ROBBINS

The satellites can't hit as high a note as we'd like, and we miss the digital input.

$400, www.creativelabs.com

Sony Clié PEG-NX80V

It's a PDA—and a flashlight!



Smile! You're on "Candid Clié"

SPECS	
CPU	200MHz ARM-based
RAM	32MB (16MB available)
Screen	320x480 TFT
Expansion	Memory Stick Pro, Compact Flash II
OS	Palm OS 5

The updated midrange Clié shows why Sony's units have been taking over the Palm OS–based PDA market. The NX80V packs in a ton of features, screams high-tech sex appeal, and offers Sony's much-admired "dual-format" approach to data input. If you need a keyboard, you have a back-lit set of keys that tucks away when the unit is closed. If you're still into the stylus thing, you can flip the screen around, fold it shut, and begin writing on a gorgeously large and evenly lit display.

Because the Clié is a Sony product, it comes with a slew of multimedia features, most notably a 1.3 megapixel camera with a 2x digital zoom. The camera, which can also capture MPEG4 video, is tuned for office lighting, and when your environment gets too dark, you can turn on an optional "capture light" to record a better picture. (It's a nice camera feature, but we've actually been using it as an emergency flashlight, we kid you not!) The camera also comes with a new neutral density filter that allows you to take pictures in bright light and still maintain correct exposure. The NX80V can play MP3 files and videos, and record voice memos. Its ARM-based processor is underpowered compared with the 400MHz monsters found in other PDAs, but we found the 200MHz power plant to be peppy enough to run all the built-in apps. We also like the ergo-correct, natural placement of all the buttons on the magnesium shell.

I/O options abound. Sony's tenacious Memory Stick makes its inevitable appearance, but as an upgraded Memory Stick Pro. There's also a Compact Flash slot that supports Sony's Wi-Fi card as well as most standard CF cards.

While the NX80V is a tour de force of features and handles like a dream, we're disappointed by its small 32MB memory payload, 16MB of which is dedicated to the Palm OS and built-in apps. Data and apps can of course be stored on a Memory Stick or CF card, but we prefer more base memory, especially in a multimedia-oriented PDA.

—GORDON MAH UNG

MAXIMUM PC VERDICT 8

+ PIN-UPS

Beautiful fit and finish. Great features. Good software bundle.

– PAPARAZZI

Lacks built-in wireless support. Needs more RAM.

$600, www.sony.com

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- 1024MB Corsair TwinX Dual Channel DDR400
- 200GB ATA133 HDD
- NVIDIA GeForce FX 5900 Ultra, 256MB Graphics
- Creative Labs Sound Blaster Audigy
- 16x DVD-Rom
- 52x CDRW
- Logitech Cordless MX Duo Elite Keyboard, MX700 Optical Mouse

Price: $1999.00

Model #: 154004-3.0K

- AMD Athlon 3000+ Processor
- ASUS A7N8X Deluxe NVIDIA nForce2 Mainboard
- 1024MB Corsair TwinX Dual Channel DDR400
- 120GB ATA133 HDD
- NVIDIA GeForce FX 5900, 256MB Graphics
- Creative Labs Sound Blaster Audigy
- 16x DVD-Rom
- 52x CDRW
- Logitech Cordless MX Duo Elite Keyboard, MX700 Optical Mouse

Price: $1799.00

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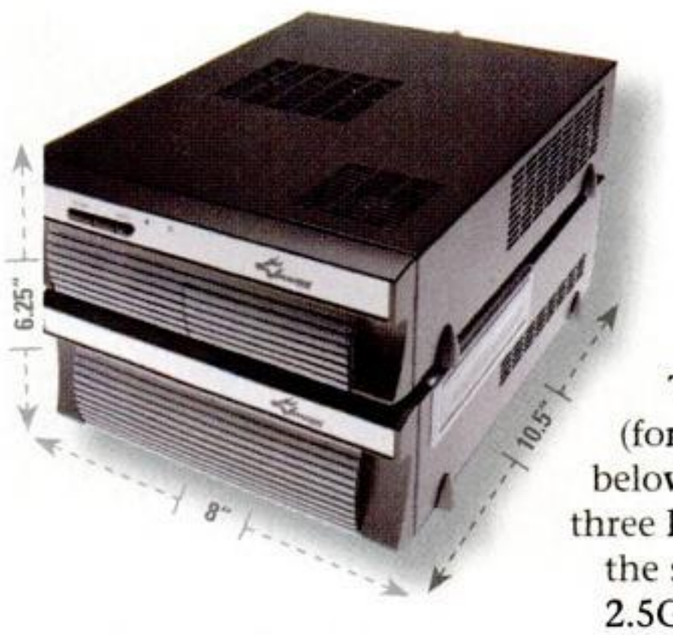
Bare-Bones PC Brawl

The small formfactor pioneer still owns the category it helped create

The MEGA sports a host of buttons and a nice big volume nob to make using its many multimedia functions familiar and fun.

With a bare-bones small formfactor PC, you typically get a petite, eminently portable case with a pre-installed power supply and motherboard. The wee mobo (usually of the Flex ATX persuasion) includes onboard support for nearly everything—audio, Ethernet, FireWire, and more—so all you need to do is install your own CPU, memory, videocard, and storage drives. Boom! The whole shebang is usually the size of a hefty lunchbox.

Shuttle more or less defined the "small formfactor bare-bones PC" category, but now competitors are flooding the market with new takes on the same idea. This month, we look at small skeletal systems from two companies traditionally known for their motherboards—SOYO and MSI—as well as a "don't call it a comeback" offering from Shuttle itself.



The MiniDragon's optional external-drive housing makes the super-small PC twice it's size.

We outfitted SOYO's MiniDragon system with 256MB of Corsair DDR and a 40GB IBM Travelstar hard drive (for reasons explained below), but otherwise all three kits were stuffed with the same hardware: a 2.5GHz Pentium 4, an ATI Radeon 9700 Pro, 512MB of Corsair DDR, and a 7200rpm IBM Deskstar hard drive.

SOYO MiniDragon 651

The MiniDragon 651 might not boast the smallest case on the planet, but we challenge anyone to show us a smaller enclosure that can still accept a full-size AGP card. Nonetheless, for all its mobility, SOYO's bare-bones offering makes some big trade-offs.

For starters, you probably won't be able to use your own P4 heatsink/fan combo. Our favorite cooler wouldn't fit, so we had to go with the custom copper heatsink that was included with the system (it's a passive cooler in name only, because a case fan blows directly onto it). Even worse, the MiniDragon's internal layout includes only enough room for a single RAM slot. And we hope you're happy using a notebook hard drive, because while a regular desktop hard drive will connect to the mobo, it won't fit inside the case. (Even the best notebook drives have traditionally run at a dog-slow 5400rpm, though IBM has just introduced the first 7200rpm drive into the mobile space.)

To compensate for a lack of internal storage opportunities, SOYO includes an external-drive housing that's large enough to host two extra storage units (it accepts optical drives, full-size desktop hard drives, and floppy drives). Problem is, it's as large as the MiniDragon itself, effectively doubling your schlepping commitment. Also consider that your external drives will be tethered to the MiniDragon via a USB 2.0 connection, so all throughput will be limited by the speed of the USB 2.0 bus. The good news is that the MiniDragon works fine as a stand-alone unit; your external drives need not be connected.

In another space-saving maneuver, SOYO engineered the power supply to live outside the case; what you get is akin to a notebook's power brick. Not only does this force you to account for yet another physical component when you're moving your PC from one place to another, you also have to deal with the PSU's awkward cabling. The cable that runs between the MiniDragon and its PSU is only about eight inches, so if you place the MiniDragon on your desk, the ugly PSU can't sit on the floor out of sight and mind.

You get six USB ports, but no legacy mouse and keyboard ports. There's also no SPDIF connector, and just three ports for audio (audio out, headphone, and mic). Rounding out the I/O situation are connectors for all the motherboard's integrated goodies: Ethernet, FireWire, and video (fine for 2D, unacceptable for 3D). As for design-friendliness, the MiniDragon's puzzle-box interior is a pain to work with. All small formfactor cases are cramped to some degree, but you'd need the hands of a five-year-old to get into some of the MiniDragon's more cramped spaces.

That said, the MiniDragon will chauffeur your 9800 Pro to the LAN party in perhaps the smallest enclosure your friends have ever seen.

MiniDragon SPECS

PSU	200 watts
Mobo chipset	SiS 651/962UA
CPU support	Socket 478 P4 with 400/533 FSB
Memory support	DDR 200/266/333
Expansion slots	One AGP, one DDR

MAXIMUM PC VERDICT 6

+ SLIM SUPERMODELS

Full AGP support in a tiny box.

– SLIM PICKENS

Too many problems to mention in this tiny space.

$300, www.soyousa.com

MSI MEGA

The MEGA is replete with multimedia features, making it an obvious centerpiece for a PC-based home entertainment system. It's also quite stylish, but much of the beauty is just skin deep. The inside of the case is a cramped mess,

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and the box just can't manage big numbers when benchmarking push comes to shove.

The MEGA is physically divided into two parts—a "Hi-Fi" interface, and a regular PC interface. Push the Hi-Fi power switch, and you'll be treated to a host of multimedia options: AM/FM radio, CDs loaded with MP3 files, audio CDs, and DVD movies (assuming you have a DVD drive installed in the box). Using all these features is easy and familiar, as the MEGA has buttons for forward, backward, stop, play, and a big old volume knob. There's even a remote control. A front-mounted LCD displays volume, spectralizer, and equalizer functions. The whole scheme is pretty damn cool. So it's therefore unfortunate that as soon as you turn on the PC power button, you permanently leave Hi-Fi mode.

Let's make this perfectly clear: PC mode supersedes Hi-Fi mode, so when you're in PC mode, you can't use the Hi-Fi mode interface. Of course, you can still access many multimedia functions through Windows applications; you just can't use the MEGA's slick physical interface.

Placing components in the confines of the poorly designed MEGA interior is a hassle. IDE cables are chopped, bundled, labeled, and pre-installed to their mobo headers, which eases drive installation significantly. Nonetheless, a cramped working space put the kibosh on any thoughts of "uneventful" component installation. Processor and heatsink installation were both difficult. And once installed, the heatsink causes problems because it interferes with the installation of the AGP card.

The MEGA's cooling strategy is poorly designed as well. Once your CPU, heatsink, and AGP card are installed, you've got your CPU heatsink fan cooling your processor (which is dandy), but also pushing hot air smack-dab on your AGP card, and from there into the middle of the case (not so dandy). As a result, the whole system runs noticeably hot.

Because of its questionable cooling potential, we'd never dare overclock a videocard housed in this machine, which is too bad because the rig's SiS mobo chipset could use an assist. Benchmark numbers were low relative to the performance of the Shuttle SB61G2, and the MEGA actually ran slower than the SOYO MiniDragon in *Quake III*, despite the fact that the MiniDragon was running the same CPU, mobo chipset, and videocard.

The MEGA comes with front-mounted USB, FireWire, SPDIF connectors as well as a 6-in-1 card reader. Yeah, we know: This wasn't enough to sway us either.

MSI MEGA SPECS	
PSU	200 watts
Mobo chipset	SiS 651/962
CPU support	Socket 478 P4 with 400/533 FSB
Memory support	DDR 200/266/333
Expansion slots	One AGP, one PCI, two DDR

MAXIMUM PC VERDICT 6

HARD ROCK

The stand-alone media center function is a clever twist.

EURO TRASH

Benchmarks don't cut it, it runs too hot, and it's cramped.

$300, www.msi.com.tw

Shuttle SB61G2

The bare-bones pioneer continues to embarrass its competitors by making the game look easy. Dig it: The SB61G2 has a clean look, great documentation, a truly roomy interior, and strong performance numbers. What more could someone ask for? Sure, it could be smaller. And, sure, it could have extra funk and freshness in the features department. But it could also come with a lot of headaches, and it doesn't.

If you follow Shuttle's step-by-step instructions, your hardware installs will be nearly hassle-free. The interior of the Shuttle SB61G2 boasts rolled metal edges at just about every place where your hands might travel, reducing the risk of injury. A removable drive cage allows for the pre-staged installation of optical and hard drives, and cable routing is also a breeze because Shuttle includes clips and guides to hold everything in place. The only real difficulty in the installation process comes when you replace the case cover. It takes some concentration and work to get everything aligned properly. But this is a small price to pay for a system that's so much fun to work on.

DARE to COMPARE	SOYO	MSI	SHUTTLE
SYSmark 2002 Overall	224	255	**270**
3DMark 2001 SE	13546	14051	**14624**
Quake III	245	228	**261**

Best scores are bolded.

The SB61G2 comes with a custom heat pipe cooling solution, which scoots most of your processor's heat directly out the back of the box. The rig also sports the new Intel 865G Springdale chipset on its motherboard, so you get support for two dual-channel DDR sticks (the SiS chipset supports just single-channel), onboard six-channel sound, Serial ATA, 10/100 LAN, SPDIF ins and outs, USB 2.0, and FireWire. Two USB ports and one FireWire port adorn the front of the chassis. And, as if that weren't enough, Shuttle's stellar documentation includes a detailed and helpful motherboard manual.

With stylish simplicity, Shuttle continues to dominate the bare-bones realm.

Running the Shuttle was smooth as silk. Benchmark figures were strong across the board, as well, showing the strength of Intel's Springdale chipset.

Thus was born a new love affair between *Maximum PC* and a Shuttle offering.

—ROBERT PALMER MOSELEY

Shuttle SB61G2 SPECS	
PSU	200 watts
Mobo chipset	Intel 865G/ICH5
CPU support	Socket 478 P4 with 533/800 FSB
Memory support	Dual channel DDR 266/333/400
Expansion slots	One AGP 8x, one PCI, two DDR DIMMs

MAXIMUM PC VERDICT 9

SHUTTLECOCKS

Well-designed. Great documentation. Strong performance.

BIRDIES

Finnicky case cover. Lacking extras, if that's your bag, baby.

$350, www.shuttle.com

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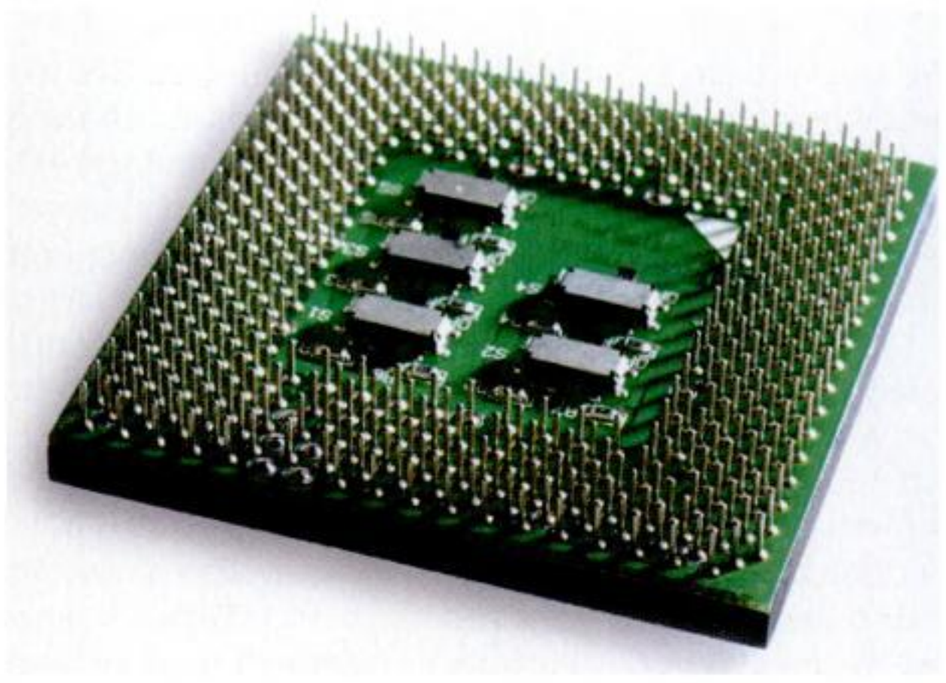
Upgradeware XP-TMC CPU Upgrade

Release your Athlon XP's inner speed-demon

As AMD's efforts to safeguard its CPU multiplier settings have evolved, so have the techniques that hardware enthusiasts employ to subvert them. Silver lacquer, sharp knives, and even power tools are all being used to "unlock" Athlon processors for overclocking.

Now, with the Upgradeware XP-TMC kit, there's a new option for changing Athlon XP multipliers. The XP-TMC, which stands for XP-Total Multiplier Controller, is a simple circuit board that fits between the CPU and its motherboard socket. Installation is relatively straightforward. First you press the CPU into the XP-TMC adapter, then you set your desired multiplier via dip switches on the underside of the adapter, and finally drop the whole assembly into the ZIF socket. The XP-TMC allows your "factory set" multiplier ratio to be altered at will—from 5x to 24x, in 0.5x increments. So, even if your BIOS doesn't support manual multiplier settings, complete multiplier freedom can still be had.

Does it sound too good to be true? Well, there are a few catches. First, the XP-TMC is designed to work with only the Thoroughbred and Barton cores. This includes just about everything on the current market, but earlier Palomino-core Athlon XP chips are not supported. Second, it required nearly the entire body weight of a *Maximum PC* editor to insert the CPU in the adapter, and one has to wonder just how much force a chip can handle before it's damaged. Third and finally, the XP-TMC adapter does not actually unlock the CPU. So even though you can assign the chip any multiplier via the dip switches, this setting cannot be readjusted through BIOS settings. This means that every time you want to change the multiplier setting, you need to dismount the cooler, remove the CPU/XP-TMC assembly, fiddle with the dip switches, and put it all back together. This can be a repetitive and aggravating act when fine-tuning an overclocked rig.



With your Athlon XP affixed to the opposite side of the adapter, you can use the dip switches pictured here to alter the proc's multiplier settings.

The XP-TMC clearly isn't the right product for hardcore tweakers who want to get down and dirty with sharp utensils and silicon gore. It is, however, possibly the only option for people trying to overclock a system with an unfriendly BIOS, or for putting a contemporary chip in an older machine with slow FSB speeds.

—DWIGHT LOOI

MAXIMUM PC VERDICT 8

+ BEDRIDDEN WITH HBO

BIOS independent. Supports all multiplier settings from 5x to 24x. Leaves CPU without tell-tale scars.

– BEDRIDDEN WITH HMO

Doesn't unlock the CPU. Costly and potentially tedious.

$30 bare/ $40 with custom cooler, www.strattoncomputer.com

EDGE DiskGO! USB Watch

A USB flash drive done James Bond–style

After the Dreams Come True company came out with its USB Toothbrush, we thought we'd seen everything the world of USB had to offer—that is, until the day the DiskGO! mysteriously appeared on our doorstep. "Ooo!," we all exclaimed. "Very secret-agenty!"

A wristwatch that doubles as a 128MB USB flash memory key? Believe it. The DiskGO! (also available in a 256MB version) is the ultimate in Bondian accoutrements—perfect for boosting files about North Korea's nuclear weapons program from top-secret government installations. The device even offers password protection for any files it stores. Of course, you might look a bit suspicious holding your wrist in front of a computer for several minutes straight. And unfortunately, you will be standing there for several minutes, because the DiskGO! only supports USB 1.1 transfer speeds.

While you're waiting vulnerably and oh-so-conspicuously for your files to copy, you may also notice that the DiskGO! is a bit uncomfortable to wear. The watch and its adjoining straps form a fixed arc of rigid plastic, so unless your wrist fits inside the arc reasonably well, you may need to convert the DiskGO! into a pocket watch. Or put it on a chain and wear it as a pendant.

As a timekeeping device, the DiskGO! has only the most basic functionality and lacks features such as a stopwatch or alarm. We also had problems connecting the watch to PCs using the included USB extension cable. Connectivity was fine without the extension, but much less convenient.

This handy gadget lets you download files *and* watch the minutes pass as you wait on its USB 1.1 transfer speed.

On the plus side, the DiskGO! is water- and shock-resistant, and can even function as a boot drive. We also love the convenience of being able to carry a few term papers—or top secrets—upon our wrists. But at nearly twice the price of a standard 128MB USB memory key, the DiskGO! should offer twice the functionality, and it doesn't. This makes it hard for us to recommend it wholeheartedly.

—OMEED CHANDRA

MAXIMUM PC VERDICT 7

+ THUNDERBALL

Slick concept, and we love being able to carry data on our wrists.

– LISENCE TO KILL

Limited timekeeping functionality. USB 1.1 transfer speeds. Slightly uncomfortable to wear.

$90 for 128MB version, www.edgememory.com

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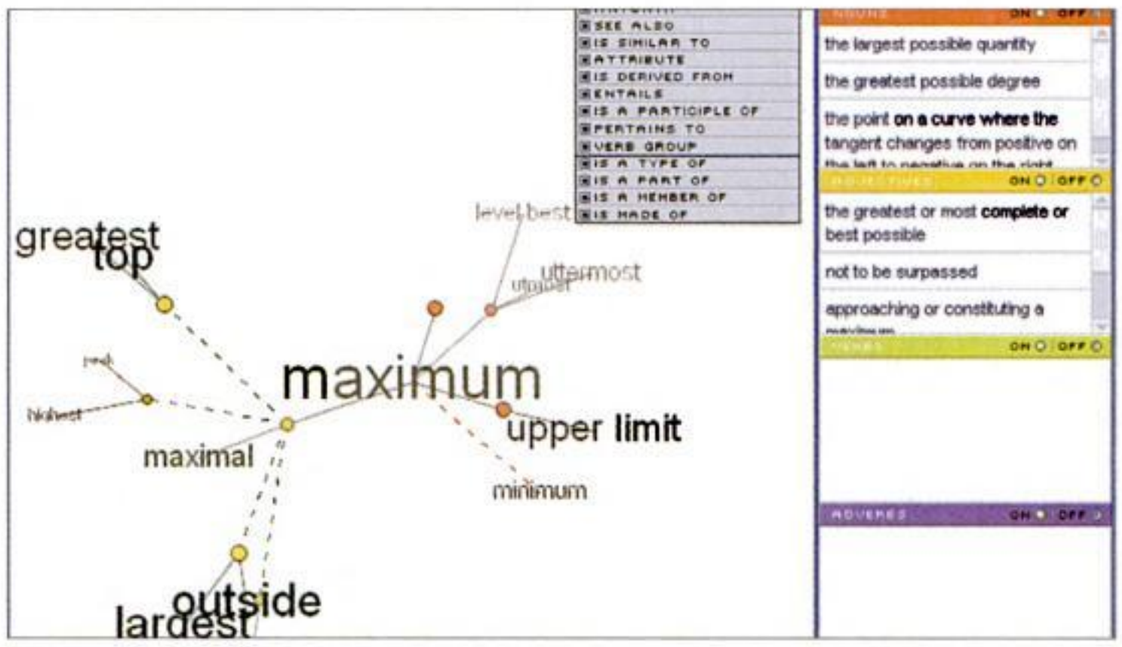
Plumb Design Visual Thesaurus

Are Roget's days numbered?



Linguistic geeks, rejoice! *Visual Thesaurus* lets you plumb the depths of the English language.

According to the Reviewers' Guide that came with our *Visual Thesaurus,* the program "changes a mundane reference product into a poetic tour de force." Needless to say, the highfalutin claim made us wary. A poetic tour de force? Now having used the program, we'd at least concur that it's "different." In a nutshell, the software combines an extensive English language database with a proprietary visualization technology to output unique word-search results. Huh? Read on.

The interface couldn't be more straightforward: Opening the program presents you with a blank screen; a box at the bottom invites you to "Enter a word." Do that, and the screen is instantly overtaken by a "spider" graph—an elaborate web of solid and dotted lines that emanate from the entered word, and connect it to all its word relatives.

We're not talking mere synonyms and antonyms, mind you. Prepare yourself for an advanced course in linguistic theory. Word relationships include such nuances as "participles of," "pertains to," and "entails," to name just a few. Indeed, the screen can become so cluttered with words and lines and dots of different colors (representing different parts of speech), you might regret having even inquired.

Fear not, there's a method to the madness. Drag the mouse over any word, and you'll get its definition. Drag the mouse over the line connecting two words, and the nature of the relationship will be revealed. Click any word on the screen and the web will reconfigure itself before your eyes, with the new word at its center.

Fortunately, you have the option of making your search more manageable by disabling some of the myriad word relationships and parts of speech that will by default appear on your screen. (Yes, it's possible to simply get the synonyms and call it a day.) We applaud the innovation behind V*isual Thesaurus:* It uses technology to animate and expand on the deeply rooted convention of traditional thesauri, and in doing so, provides an insightful, if somewhat arduous, journey through the English language. But make no mistake, a user has to really want more than a traditional word finder for the app to be useful.

—KATHERINE STEVENSON

MAXIMUM PC VERDICT 8

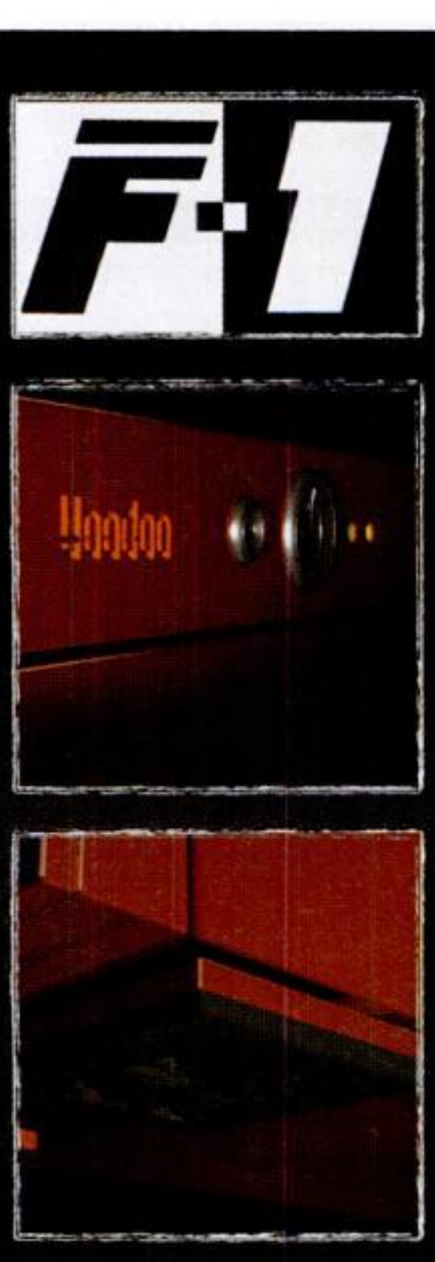
SYNONYMS

Offers loads of information in a dynamic, nonlinear format.

ANTONYMS

Can be a bit overwhelming and unwieldy with all its capabilities enabled.

$30, www.visualthesaurus.com



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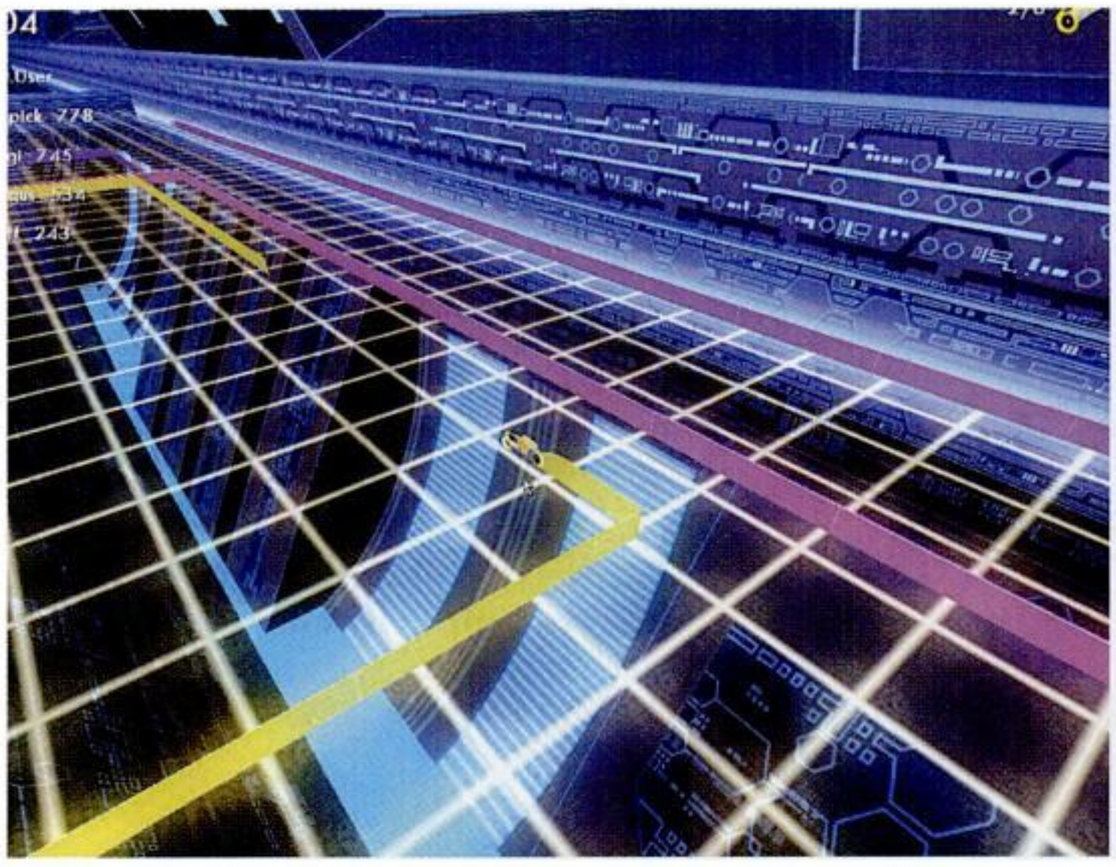
Tron 2.0

Glow very new one, glow like the wind!



Going into a death spiral, Icepick_778 walls off the escape.

Tron 2.0 is beautiful and enchanting, a bright and glowing spectacle that's also a joy to play. In the game—a first-person shooter with racing elements—you reenact combat glories from the 1982 film *Tron*. This entails throwing glowing discs, driving motorcycles that leave a trail of light, and using other cool tools that befit a 20-year upgrade. *Tron 2.0* offers three different gameplay modes: a single-player story mode, a light-cycle career mode, and a multiplayer mode.

We couldn't help but be dazzled by the game's visual texture. Everything hums and glows, with walls, panels, and boxes shining as if imbued with a spiritual significance. The architecture is detailed and soaring, and can often produce a real sense of vertigo. Moving about the physical environment evokes appropriate changes in the audio environment, as well: Humming machinery and system announcements provide great auditory feedback as you wander through the computer world.

The single-player game is compelling and fun, all told through in-game interactions, cutscenes, and e-mail that you find and download throughout the plot. You play as Jet, the son of Alan Bradley, who was also Tron in the original movie. In-game episodes are just the right size and well-contained, and the puzzles, while simple, are challenging enough. The single-player game features an innovative system to grow your character through "upgrading." Each time your character reaches a new "version" (usually at the end of a major plot point), you're given a number of development points to add character attributes. You can also collect "sub-routines" that allow you to otherwise increase your abilities.

In the single-player game, it's easy to duck behind a corner or box and turn your hot-on-the-heels pursuer into a lost-and-confused rent-a-cop. However, bots in light cycles more than make up for their dumb cousins on foot. Even the dumbest light-cycle bots get much more out of their cycles than meat fingers and brains can.

—ROBERT PALMER MOSELEY

MAXIMUM PC VERDICT 8

+ C++

Compelling storyline, good episodic play, innovative character development, rocking visual and audioscapes.

– COBALT

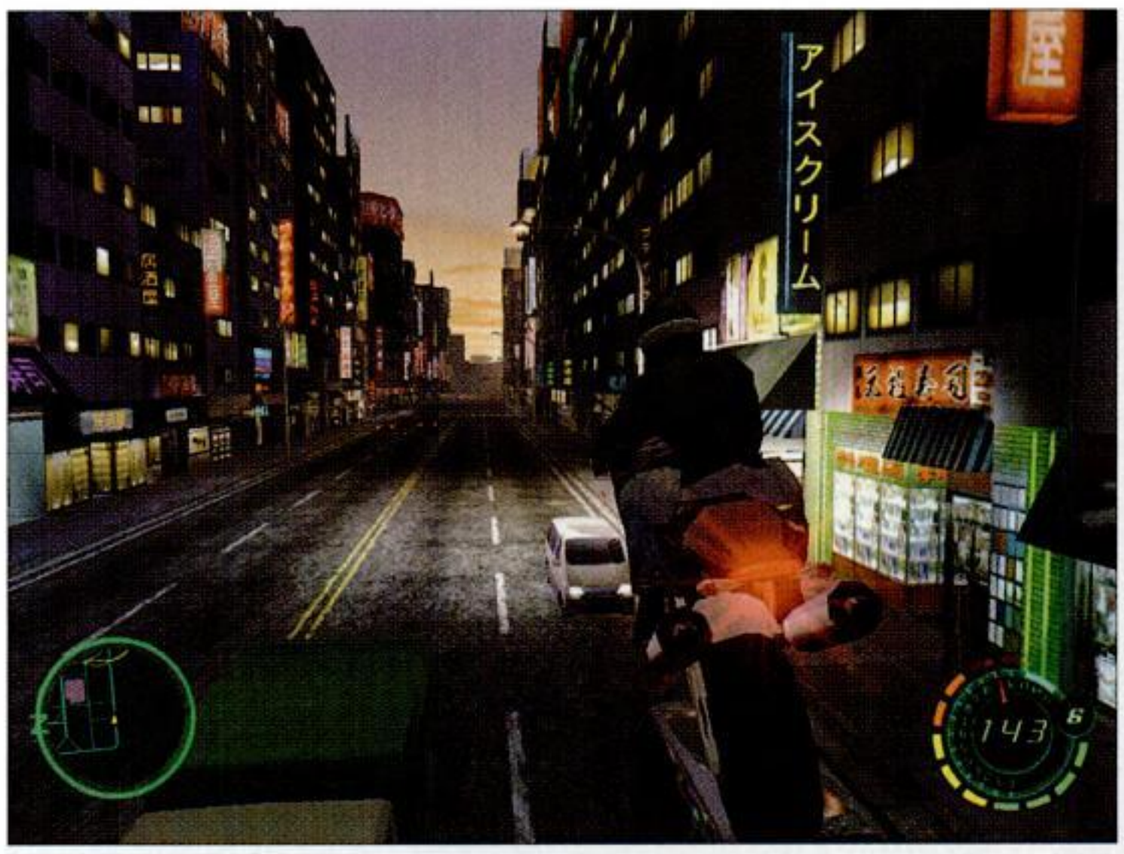
AI is either too hard or too soft.

$50, www.lith.com

Midnight Club II

Street racing that's faster and furiouser

MAXIMUM PC KICK ASS PRODUCT



It's a bird! It's a plane! No, it's a maniac on a motorcyle!

You're rocketing through the streets of L.A. at over 150 miles an hour in a tricked-out Honda Civic-esque car. After you swerve around a bridge abutment, you pull your eyes from the road just fast enough to glance in the side mirror, only to see a motorcycle blow by you, and zip out of sight around the next corner. You make the turn, and punch your nitrous to catch up, but instead you wrap your ride around a phone pole. Them's the breaks in the underground world of *Midnight Club II* street racing.

Midnight Club II pits you against a wide variety of cars on the streets of Los Angeles, Paris, and Tokyo. Winning races unlocks more cars, more hardware modifications, and new cities to race in. Sounds standard, right?

We've played loads of street racing games that include real cars—*Midnight Club* has imaginary vehicles—and even these titles weren't anything special. But two things set *Midnight Club II* apart: pseudo nonlinear progression, and loads of well-balanced cars and motorcycles. After some tutorial races, you're set free in a loose approximation of Los Angeles. From that point on, you choose your races by driving around, looking for other racers, and then flashing your high beams at them. Once you've utterly defeated a racer, you're ready to move on to the next victim.

The game's actual racing is challenging enough to be fun, but isn't so difficult that you'll constantly be frustrated. The physics model feels accurate, both in cars and motorcycles, and it's necessary to use your handbrake to make precise turns. We also like the fact that the motorcycle physics model gives you two turning options; you can either use the handlebars or turn by leaning. Super cool!

Midnight Club II is a multi-platform title, so it doesn't look as good as most pure PC titles. Nonetheless, we were able to run the game at 1600x1200 with all the detail cranked up on a Pentium 4 2.4GHz with a Radeon 9800 Pro. Let's see a PS2 do that!

—WILL SMITH

MAXIMUM PC VERDICT 9

+ DIESEL FUEL

A fun racer that requires lightning-quick reflexes and a keen eye for the road. Nonlinear gameplay.

– VIN DIESEL

Trashing cars from the real world would be more fun, but we wouldn't have seen any wacky names, like the Modo Prego.

$40, www.midnightclub.com

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Star Wars Galaxies: An Empire Divided

The much-anticipated MMORPG is lovely, huge, and boring

With the possible exception of The Rapture, few events in human history have been as anxiously anticipated as the launch of *Star Wars Galaxies*. Continents quaked, societies reordered themselves, and tender hearts leapt from bridges every time this game was delayed. But now—huzzah!—the day of Its Coming is at hand.

If only we could see the monitor through our tears of joy, maybe we'd be able to figure out what all the slobbering was about.

Actually, the answer to that is pretty clear. George Lucas has pumped some kind of high-grade, pop-culture crack deep into our brains, so when we hear "Star Wars massively multiplayer online RPG," we imagine taking an active role in shaping the epic stories that we cherish. What we got, however, is *EverQuest* with Wookies.

OK, Wookies and better graphics and a vastly improved interface.

You might wonder how many people can toss the Emperor to his death or rescue Leia from Jabba the Hut. In other words, how many of us will be heroes, and how many will be red-shirts? *Galaxies*, as of the first month of its release, is a game full of red-shirts (a term inspired by the disposable ensigns on *Star Trek*). This may well change as the story and world grow, but right now, much of the game is disturbingly mired in simple drudgery, and there seems little hope of changing that because drudgery appears fundamental to the very structure of the game.

Galaxies starts off with a bang. Rousing music, a universe full of planets, eight races to choose from, and worlds to explore at your leisure. Though race choice doesn't have a huge impact on the game, class choice does. There are six professions to choose from: brawler, scout, and marksmen are the most popular because they involve different forms of combat. Medic, entertainer, and artisan, on the other hand, have a more nebulous appeal, though surely those curious folks who spent 500 hours making shoes in *EverQuest* will jump at the chance to um, well, dance for people. *Galaxies* was designed to make these six professions equally important and essential to one another, and therein lies one of the game's core design problems.

Wouldn't it be cool to play as a Stormtrooper? You can if you make friends with the Imperials and save enough credit.

Sony Online Entertainment muddied-up the simple health, action, and mind points used to track a character's well-being by making all the statistics interdependent. The new scheme is somewhat complicated, but it boils down to this: Certain kinds of damage can only be healed by returning to town and watching an entertainer or visiting a medic. While the complex skill and combat system—complete with location-based injuries and interdependent stats—is appealing in theory, it ultimately works against the game, creating a great deal of back-and-forthing as low-level players constantly return to town to patch up or risk suffering permanent damage.

Yet there is much to thrill at in this game. The interface is marvelously sleek and usable despite all the complex gameplay elements one has to handle. And visually, *Galaxies* is the best MMRPG to date. Period. Seeing planets like Tatooine and Endor come to life—in 3D with plenty of character and detail—is quite a charge. The game also runs remarkably well despite its high detail level, with smooth transitions from city to outskirts, and from outdoors to in. Although cities are bustling centers, one thing is missing: markets. The game relies on simple kiosks to manage the user-driven economy; objects are bought by bidding in an auction or by paying a set price. Unfortunately, this only highlights *Galaxies'* unfinished feel. For such a complex game, there are far too few different types of objects and weapons to accumulate. Right now, the universe is also completely missing vehicles, which means you can forget about making the Kessel Run in less than 12 parsecs.

Ultimately, there just isn't much to do in this huge, admirably crafted world. Much of the game is certainly thrilling, but after a little bit of stat-pumping, the dreaded repetitiveness sets in. If the game is expanded and becomes more dynamic and interesting, this could become less of a problem, but right now *Galaxies* is a hundred miles wide and an inch deep.

—THOMAS L. MCDONALD

Is that its head or its ass? Either way, it spells trouble if you pick a fight with this monster.

MAXIMUM PC VERDICT 6

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building the best systems since 1990

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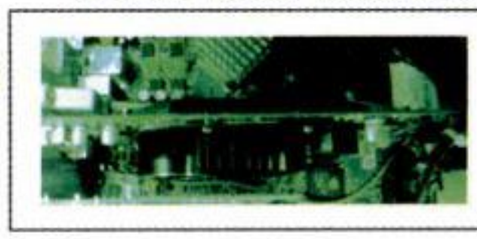

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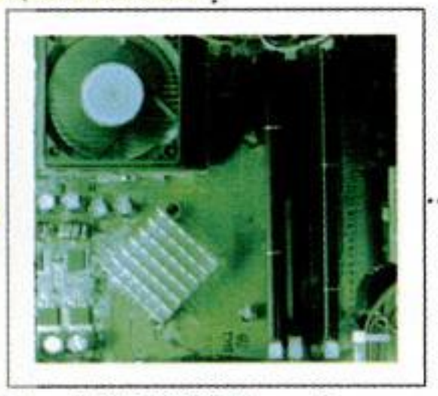

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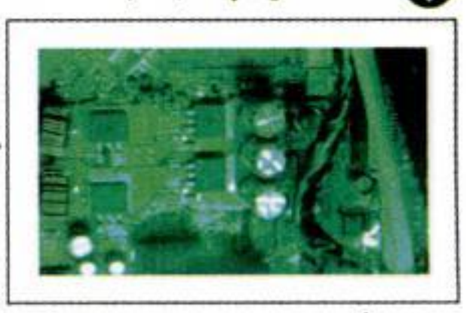

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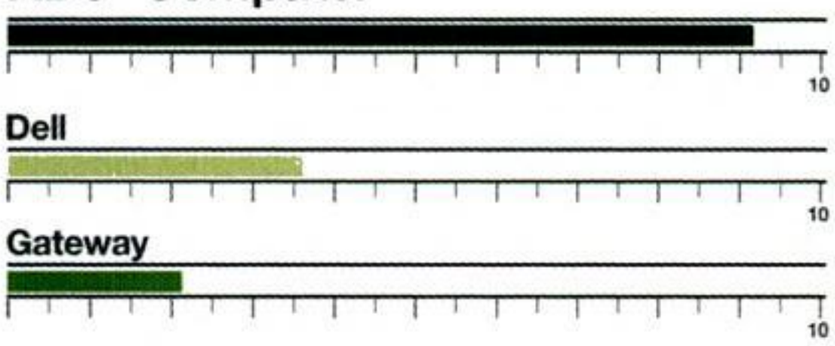

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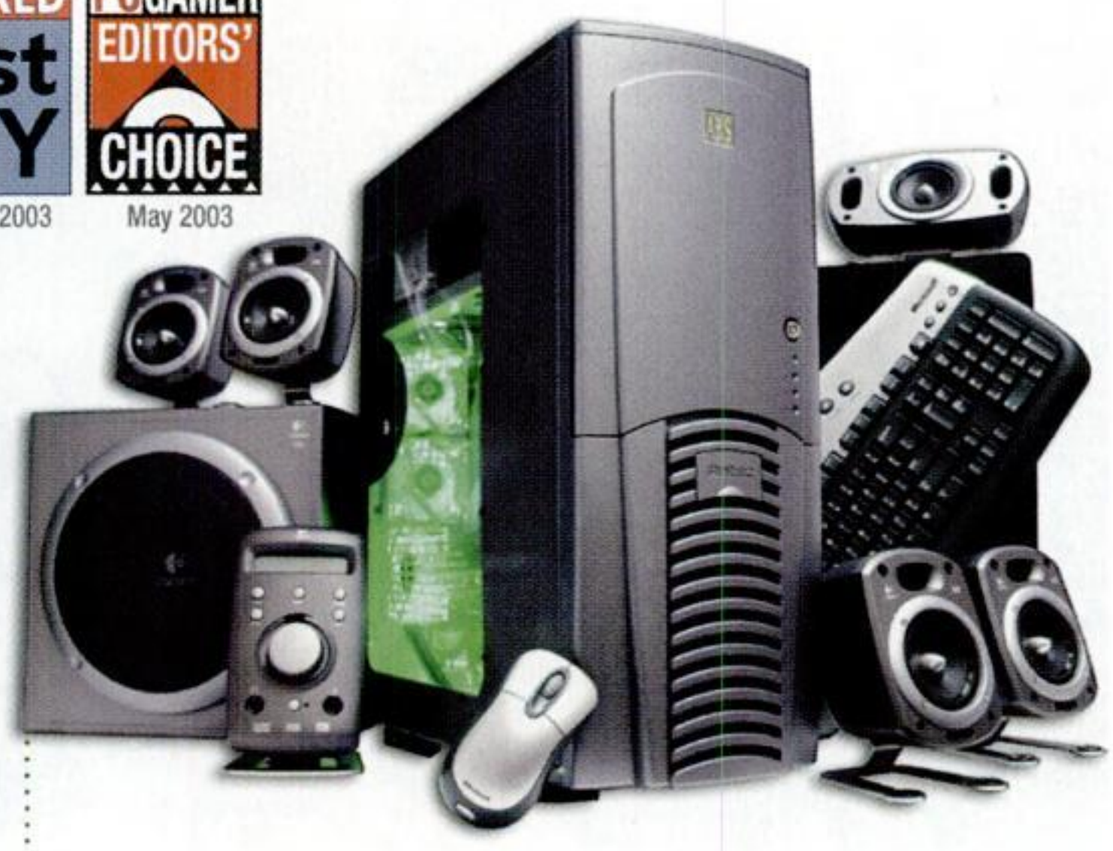

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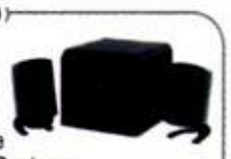

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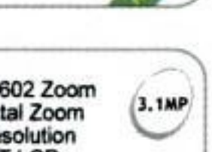

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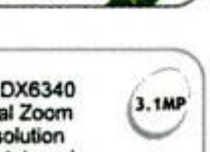

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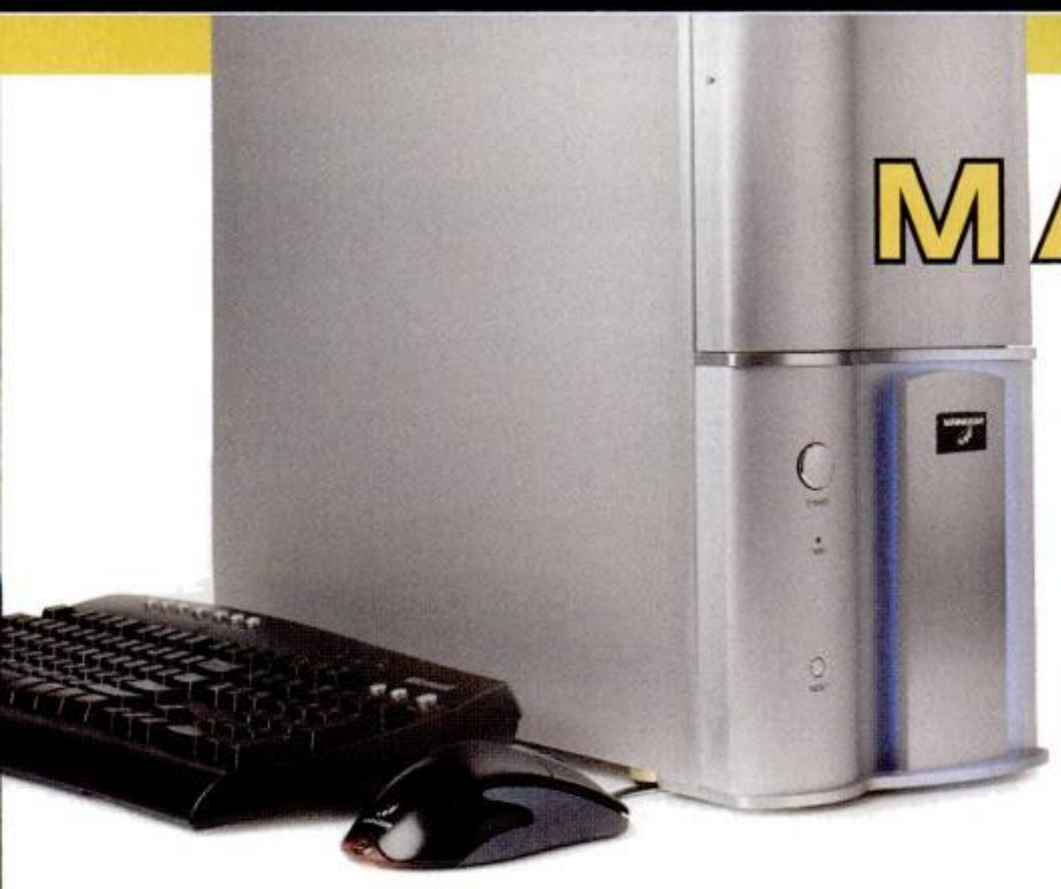

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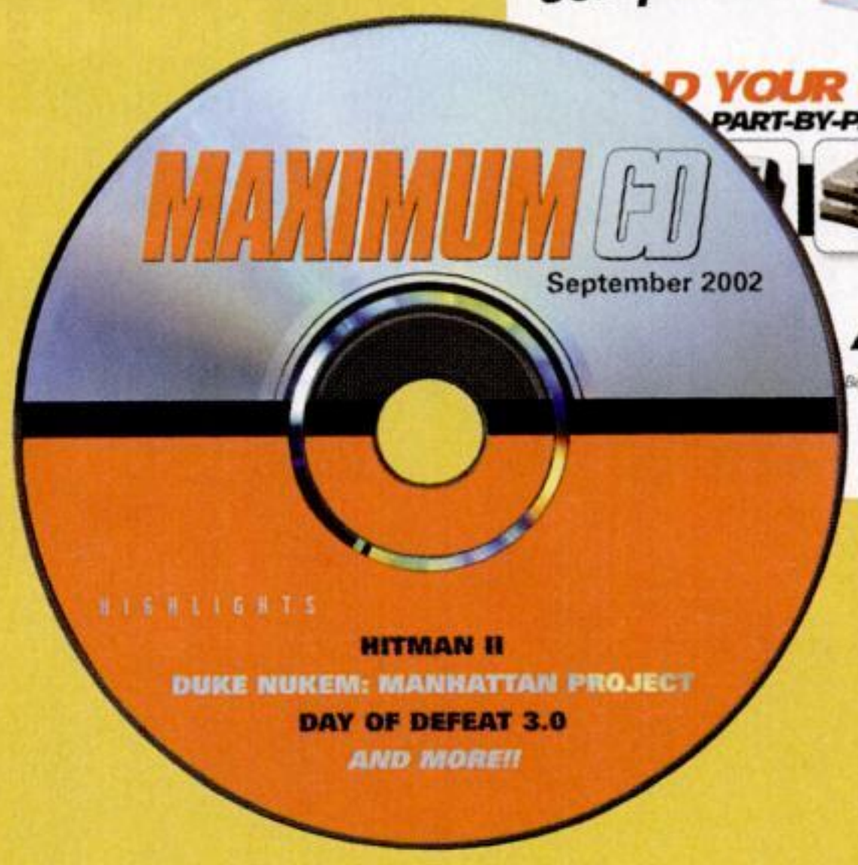

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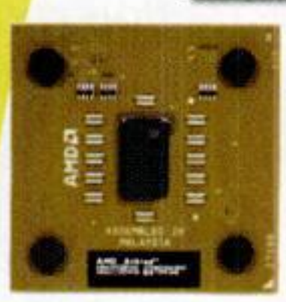

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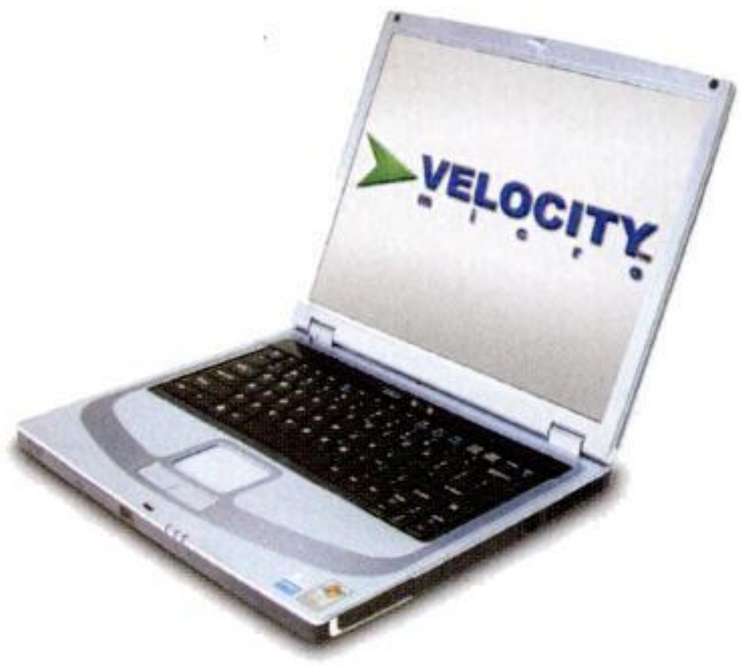

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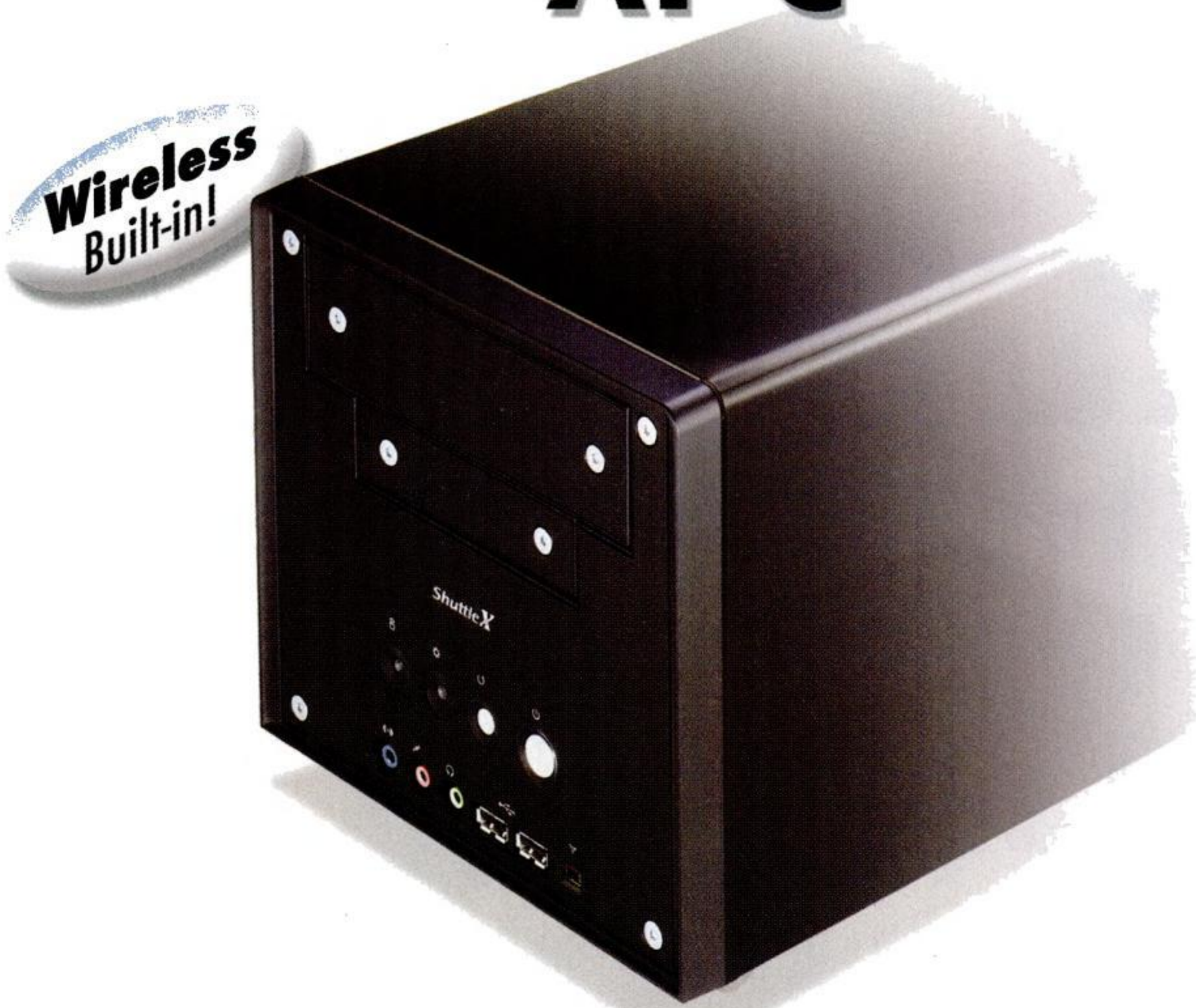

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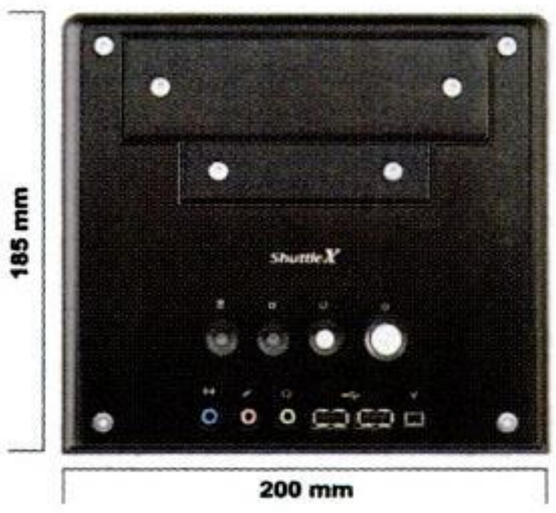

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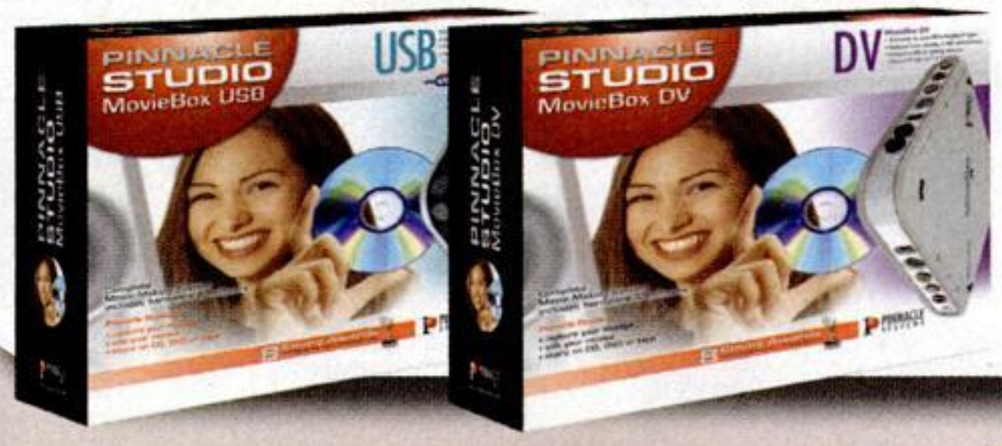

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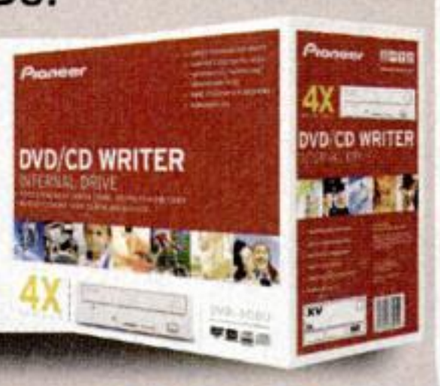

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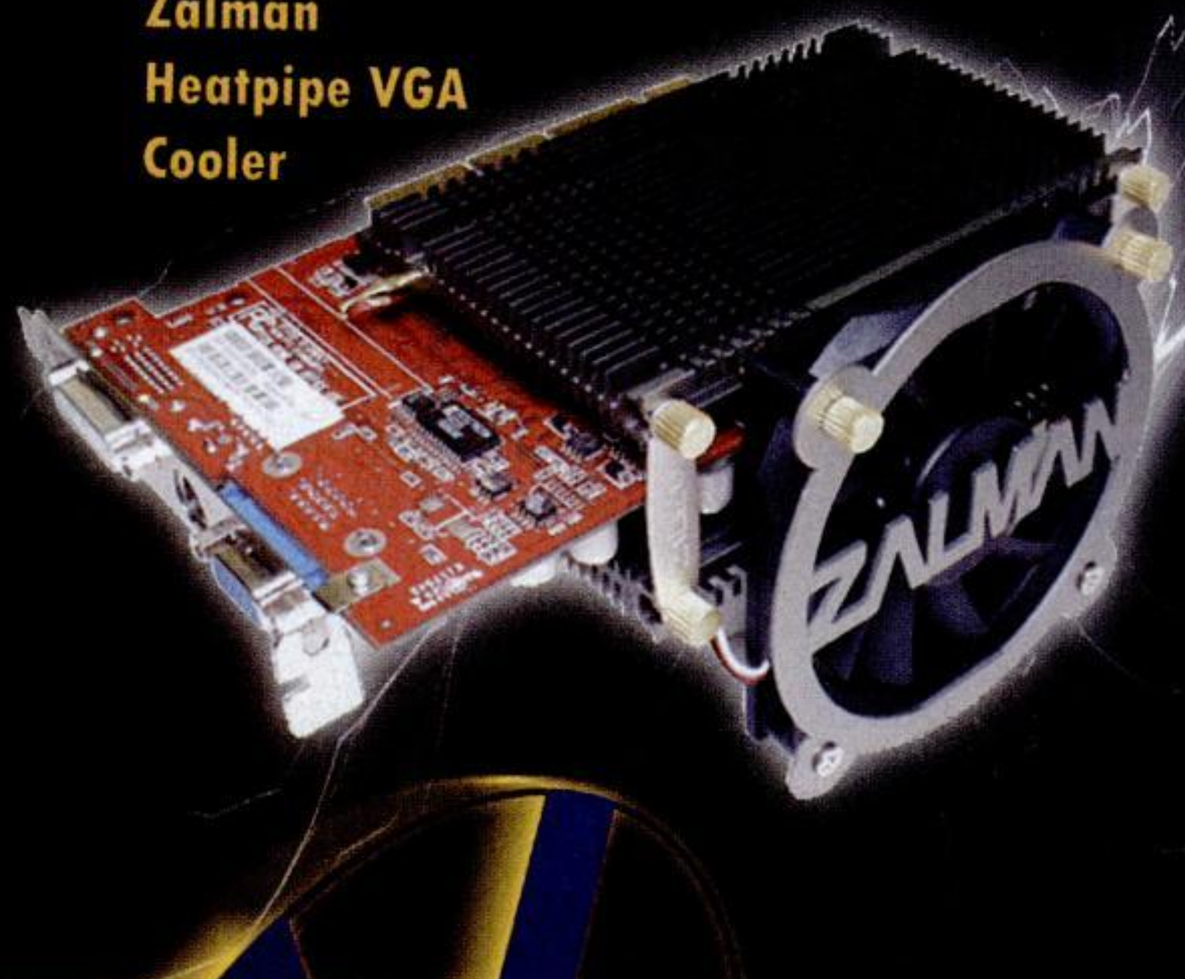

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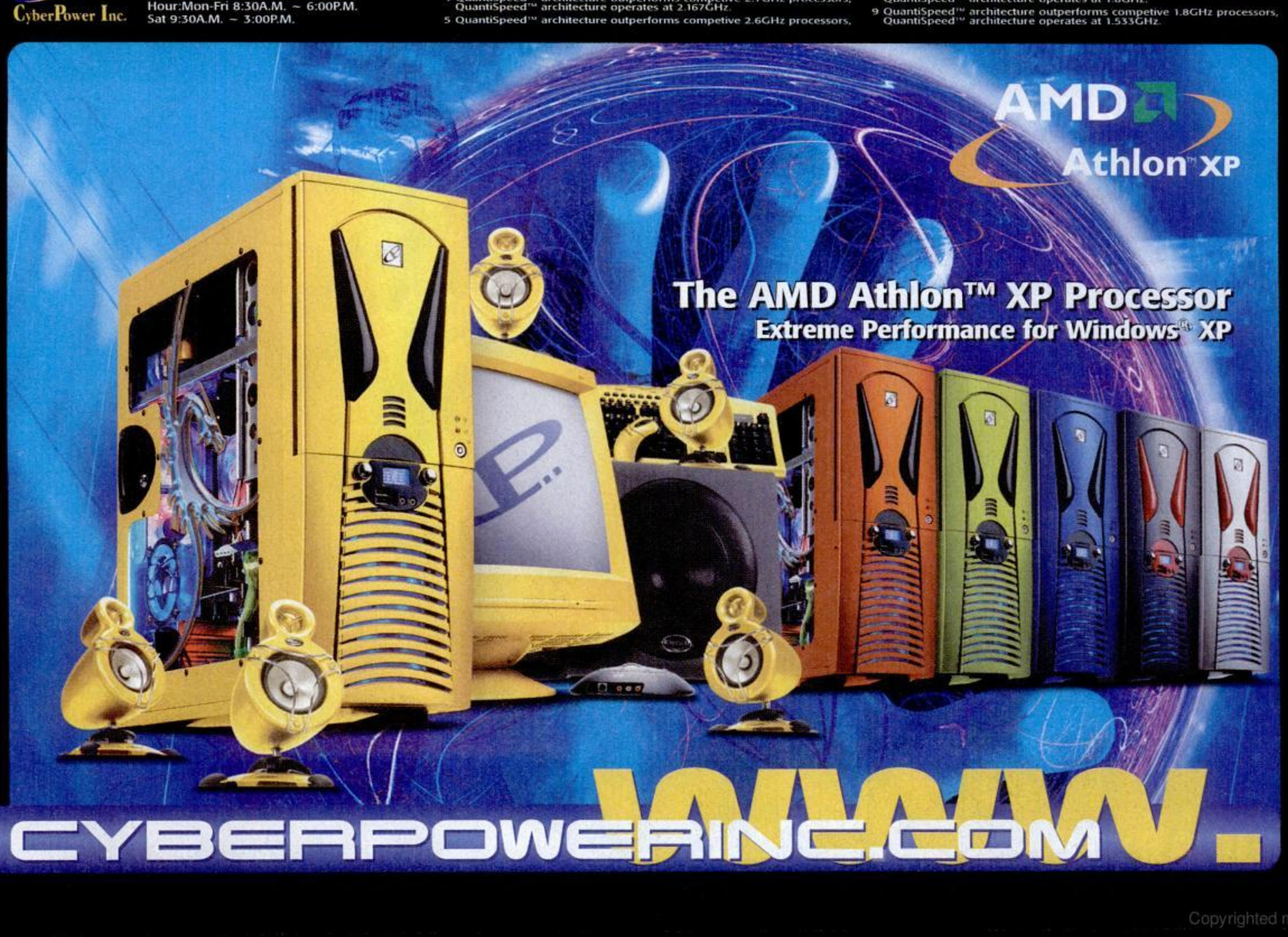

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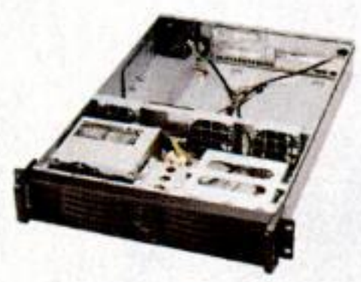

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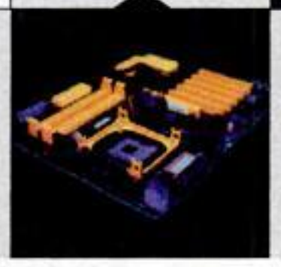

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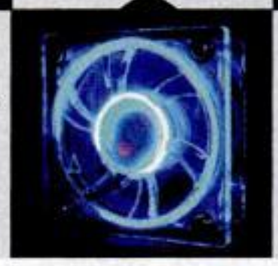

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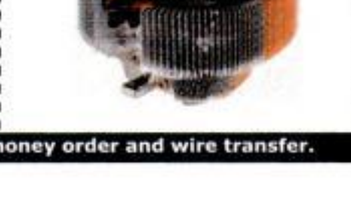

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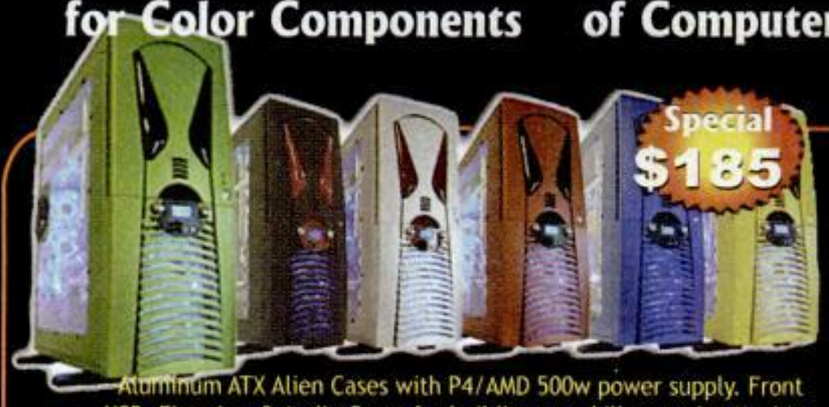

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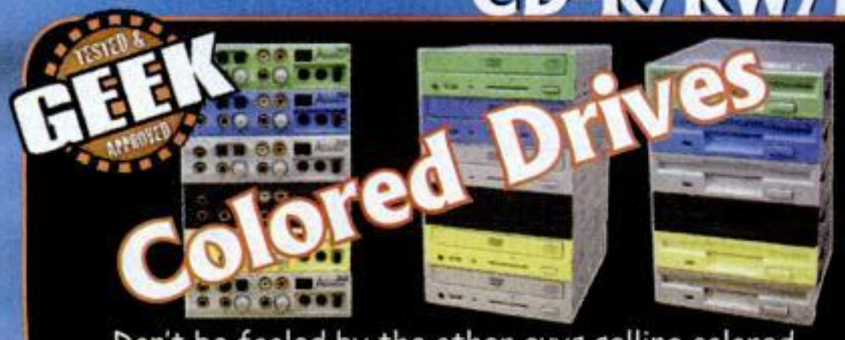

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52x24x52	IDE	Teac CDW552	$60	$75
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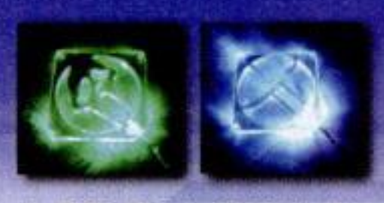

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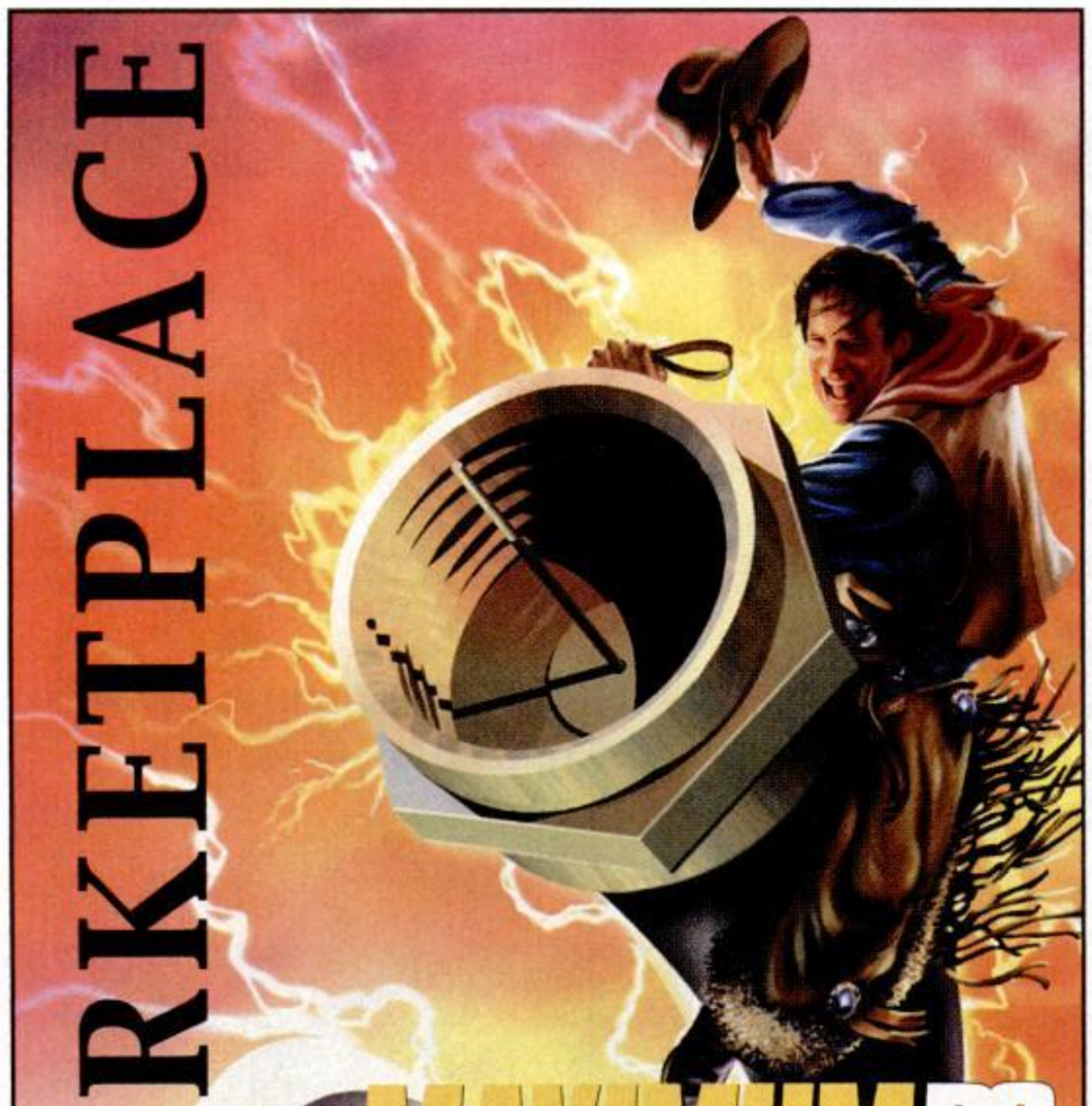

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If your modded PC is chosen as a Rig of the Month, it will (1) be featured before all the world in *Maximum PC*, and (2) win you $1,000 and a case of BAWLS high-caffeine soft drink. So what's stopping you?

TO ENTER: Your submission packet must contain your name, street address, and daytime phone number; no fewer than three high-res JPEGs (minimum size 1024x768) of your modified PC; and a 300-word description of what your PC represents and how it was modified. E-mailed submissions should be sent to **rig@maximumpc.com.** Snail mail submissions should be sent to Rig of the Month, c/o Maximum PC, 150 North Hill Drive, Suite 40, Brisbane, CA, 94005.

The judges will be Maximum PC editors, and they will base their decision on the following criteria: creativity and craftsmanship.

One entry per household.
Your contest entry will be valid until (1) six months after its submission or (2) May 1, 2004, whichever date is earlier. Each month a winner will be chosen from the existing pool of valid entries, and featured in the Rig of the Month department of the magazine. The final winner in this contest will be announced in the July 2004 issue. Each of the judging criteria (creativity and craftsmanship) will be weighed equally at 50 percent. By entering this contest you agree that Future Network USA, Inc. may use your name, likeness, and web site for promotional purposes without further payment. All prizes will be awarded and no minimum number of entries is required. Prizes won by minors will be awarded to their parents or legal guardians. Future Network USA is not responsible for damages or expenses that the winners might incur as a result of the Contest or the receipt of a prize, and winners are responsible for income taxes based on the value of the prize received. A list of winners may also be obtained by sending a stamped, self-addressed envelope to Future Network USA, Inc., c/o Rig of the Month, 150 North Hill Drive, Brisbane, CA 94005. This contest is limited to residents of the United States. No purchase necessary; void in Arizona, Maryland, Vermont, Puerto Rico, and where prohibited by law.

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MAXIMUM PC Rig of the Month

Fueled by BAWLS

Mod. Overclock. Never Sleep!

THIS MONTH: Scott Clark's "Industrial Revolution"

No, it's not a miniature of a Soviet-era nuclear facility, nor is it a heavy-duty commercial sausage maker. Unlikely as it seems, this is one man's personal computer, and from what we can tell, its activities are on the up and up.

In fact, it's possible to closely monitor the operation of Scott Clark's rig, because all the dials and knobs and display devices that make it look so cool are also fully functional. In part, these doo-dads control the elaborate water-cooling system that keeps Clark's 1GHz AMDT-Bird running at a stable 1.43GHz.

The looming column to the right of the PC is the Evaporative Cooling Tower. That, the Danger Den Maze 2 water block behind it, and a centrifugal pump in the box at the front move a steady stream of liquid in and around the rig. According to Clark: "The CPU temp at a full load is generally about 40° C." Not bad for a 43 percent overclock.

Granted, the setup has its drawbacks. "The Evaporative Cooling Tower is really a great thing, but has two problems," says Clark: "One is that it pumps a lot of humidity into the room—I've actually used a dryer hose to vent it out a window—and the other is the stuff growing in it. I've had to take the pump apart and clean it out after about every 200 hours of operation."

Still, Clark is quite satisfied with the results of his hard work ("and the looks it gets are priceless," he says). The only thing he would do differently is build the case itself from scratch!

Color us impressed.

"Part Thomas Edison, part 21st century," was Clark's aim.

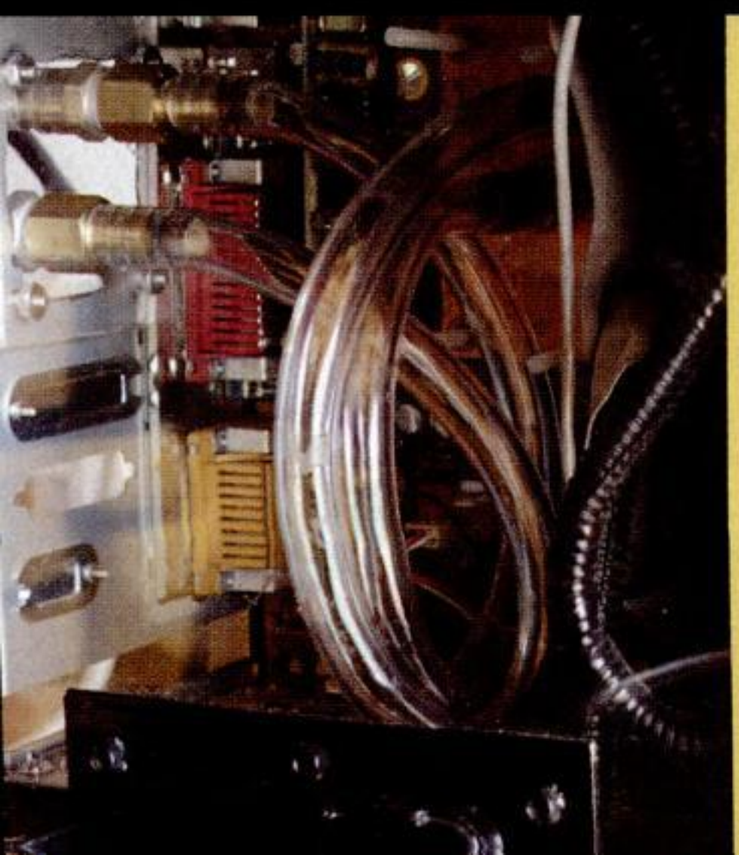
Original vintage instruments acquired on Ebay, and the liberal use of Allen head cap screws to hold things in place helped him achieve that aesthetic.

"And it doesn't just look cool…it actually crunches numbers surprisingly well," he says.

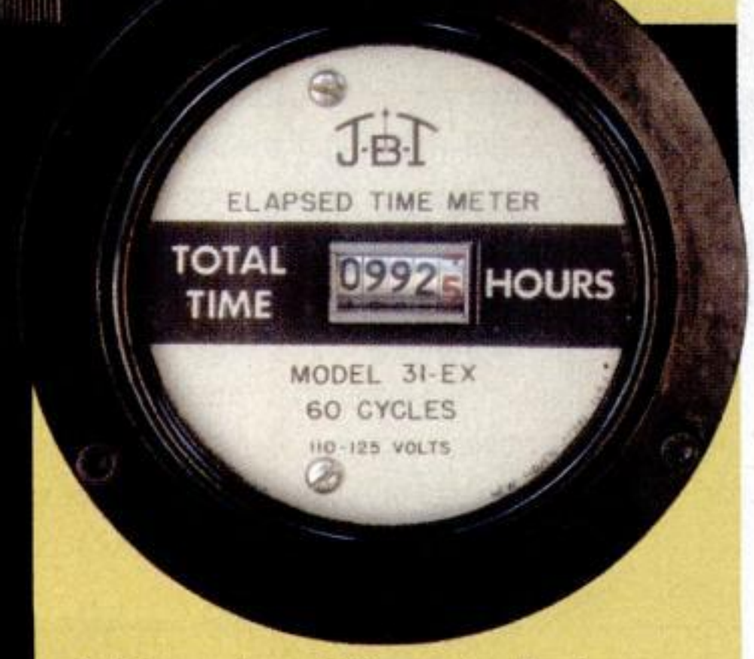
Please remain behind the red line when the machinery is in operation.

The various 110V subsystems can be controlled either individually or via a single master switch.

A needle indicates how much voltage is going to the 115 CFM centrifugal blower that helps cool the case.



Clark added a Lexan window to the side of the case, making it possible to view the water block and all the lines running to it.



A vintage elapsed-time meter displays the number of hours the PC has been powered-on.

For his winning entry Scott Clark wins $1,000 and a case of BAWLS to fuel his late nights of modding. You can win too! See previous page for

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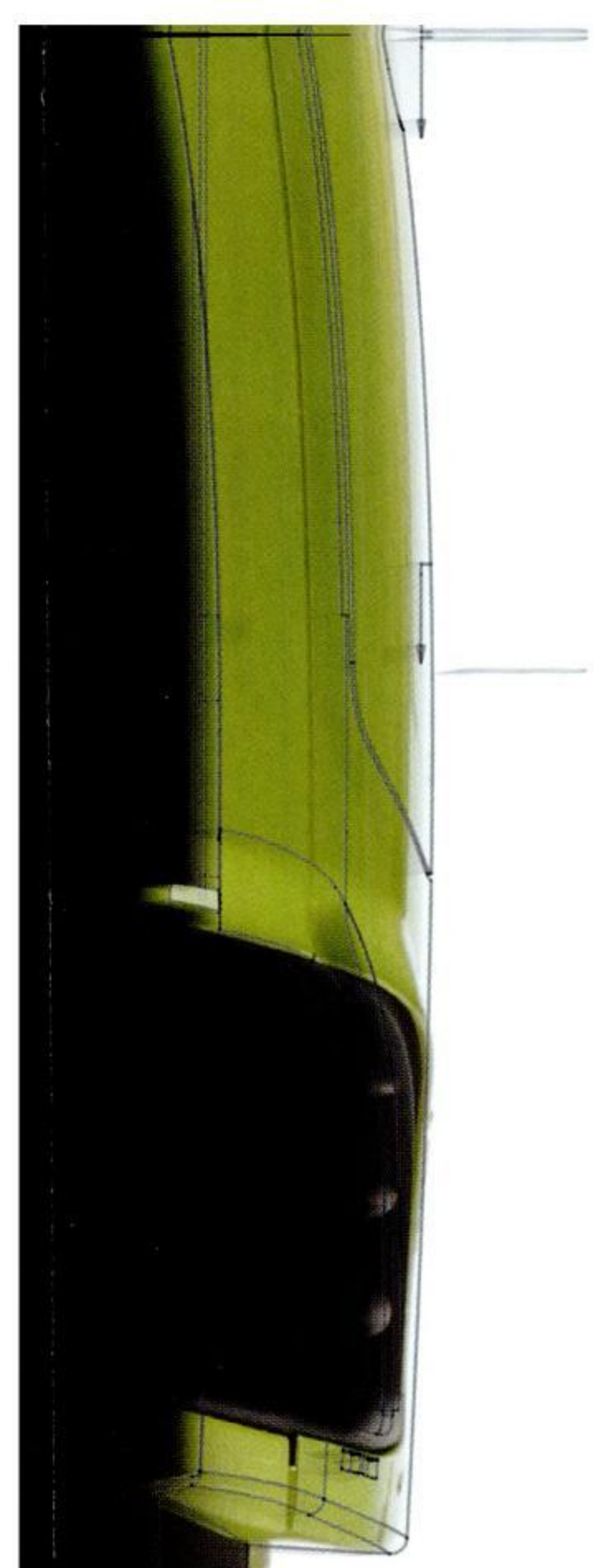

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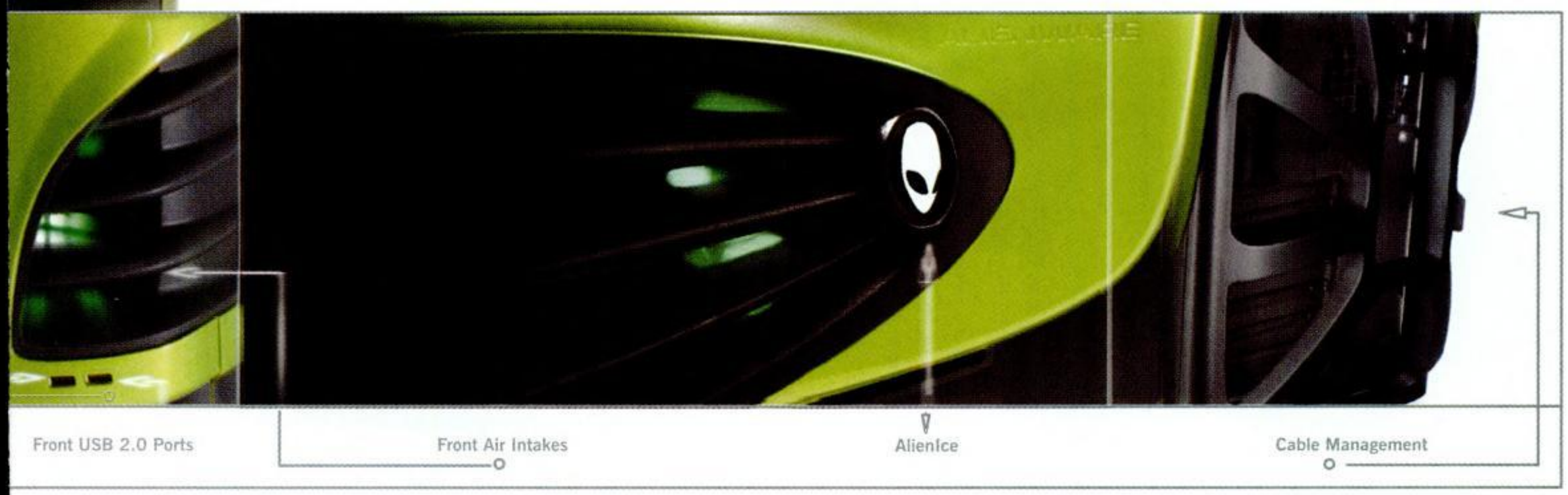

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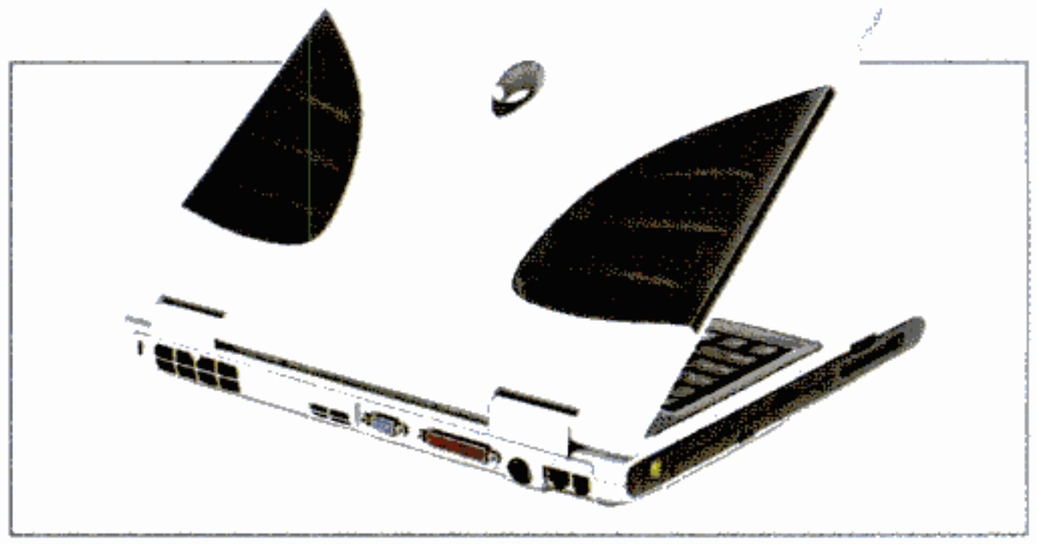

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